THE FOUNDRY

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The Avery Molding Machine.

Progress along well known lines is continually being made and does not attract a very marked attention, because the changes are founded on the results of experience, and except in the matter of details agree with established principles. Occasionally improvements are made which are directly opposite to current practice and entirely in discord with ordinary conceptions of how a thing should or could be done. Among the latter we must class the Avery Molding Machine, the invention of Mr. Geo. C. Avery, first used by B. F. Avery & Sons of Louisville, Ky., and now manufactured for the trade by the Whiting Foundry Equipment Co., of Chicago.

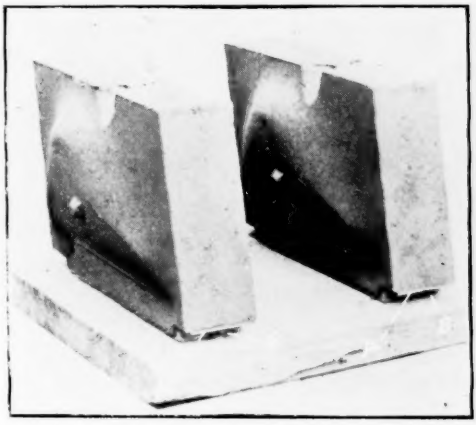


FIG. 1.

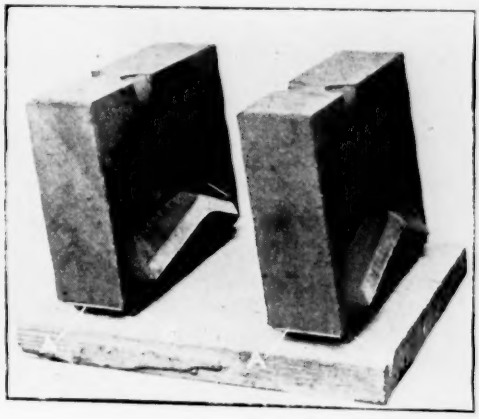


FIG. 2.

Not only the apparatus itself but the plan of molding throughout is in such strange contrast to what we have been accustomed to consider as molding, that even if the whole thing was merely a suggestion or an experiment it would be worth a description. Coupled with the fact that in practice this system of molding has fulfilled more than was expected of it. There is the more reason for giving it extended notice. The reader may in his own shop have several kinds of castings to which this and other processes do not seem to be applicable, in which event he should consider this as an invitation to design something which will supply his own wants.

The machine which we illustrate herewith was designed for the special purpose of making plow points, though with a few alterations as to details it may be arranged to turn out many other kinds of castings. It may at first appear as if a machine on this kind of work would accomplish but little more than hand labor, though it should be remembered that appearances even as to possible output are deceptive. One thing which must be conceded to all articles produced by machinery, and this includes castings, is a greater exactness and uniformity. Where interchangeability is desired it needs but little argument to prove that the machine-made article is the peer of the one made by hand.

Though many castings are cast in a vertical position they are, with but few exceptions, molded horizontally and two parts, cope and drag, are generally considered necessary to form the mold, except in open sand work. The Avery machine differs from oth-

ers not only in that it forms the mold in a vertical position, but also in that it makes a complete casting in every single part it turns out, there being neither cope nor drag as those terms are commonly understood. To make our words clearer we must refer to Figs. 1 and 2. It will be observed that if we place the molds in these illustrations together we would have two complete plow points, and it is also evident that by obtaining two more parts as shown, and placing them alongside of those we already have, we should have four points. Each side of the faces, one of which rests on the bottom board and the other furnishes a place for the common weight used in pouring.

Fig. 3 shows the floor as constructed and its appearance at the beginning of a day's work. No flasks are used in handling these molds, the sand resting on bottom plates A Figs. 1 and 2, which are provided with guides, B, fitting the grooves, C, Fig. 3, and causing the molds to keep the same position laterally, the uniform height of this plate keeping the molds in the correct position vertically. A plank, D, at the back end of the

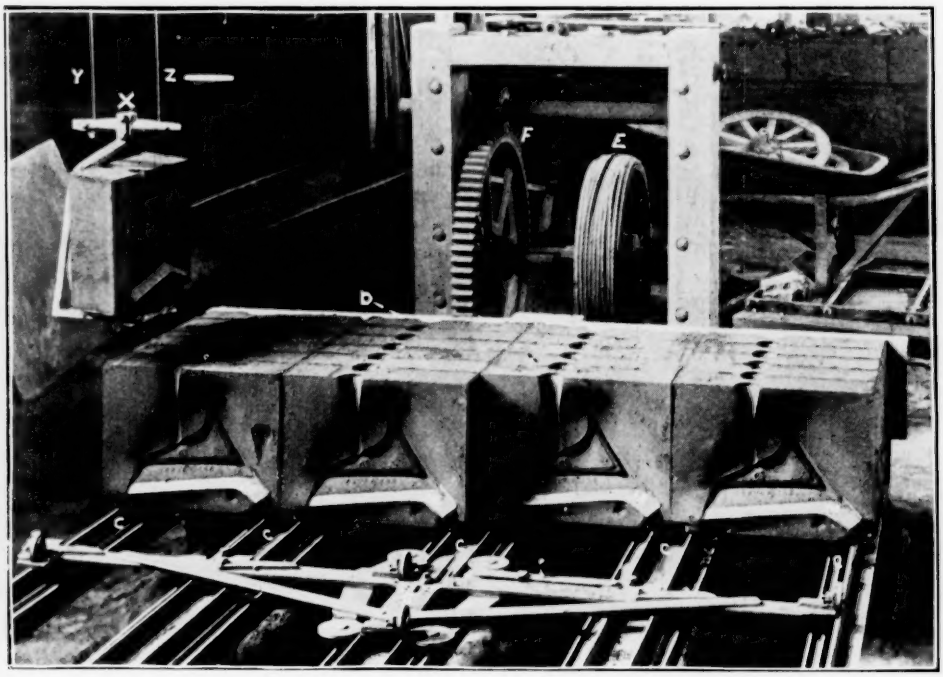


FIG. 3.

mold containing an impression equal to either the drag or cope side of an ordinary mold, we secure a complete casting from each part, just as we would if this part was divided into two sections and these placed face to face. Perhaps the reader can form a better conception of how these molds are made by supposing that the cope and drag of an ordinary mold were placed back to back and molded simultaneously in that position, when it is evident that each side of the mold would represent one-half of the outline of the pattern instead of the flat surface, serves as a support at the beginning, the extending projections of the mold, as shown at Fig. 1, being leveled off to permit a solid backing. Before beginning to cast the molds forming the front end of the floor are secured by a similar arrangement. Should there be the smallest part of an opening between the molds lengthwise, this is tightened by the pouring of a few molds, which support one another against the pressure caused by the inflowing metal.

The rope wound drum, E, shown in the background of Fig. 3, together with the

gearing, F, shown in the same place, and the rigging, G, in the foreground of the illustration is used to clear the floor after pouring. As the floor as constructed holds 700 molds, it will be seen that it would require considerable labor to transfer this sand back to the machine if the molds were dumped where poured. By the arrangement shown a number of molds are pulled towards the rear end of the floor, where the castings are picked out and the sand falls into a receptacle leading to a large revolving Riddle and conveyor, during its passage through which the sand is tempered and made ready for use again.

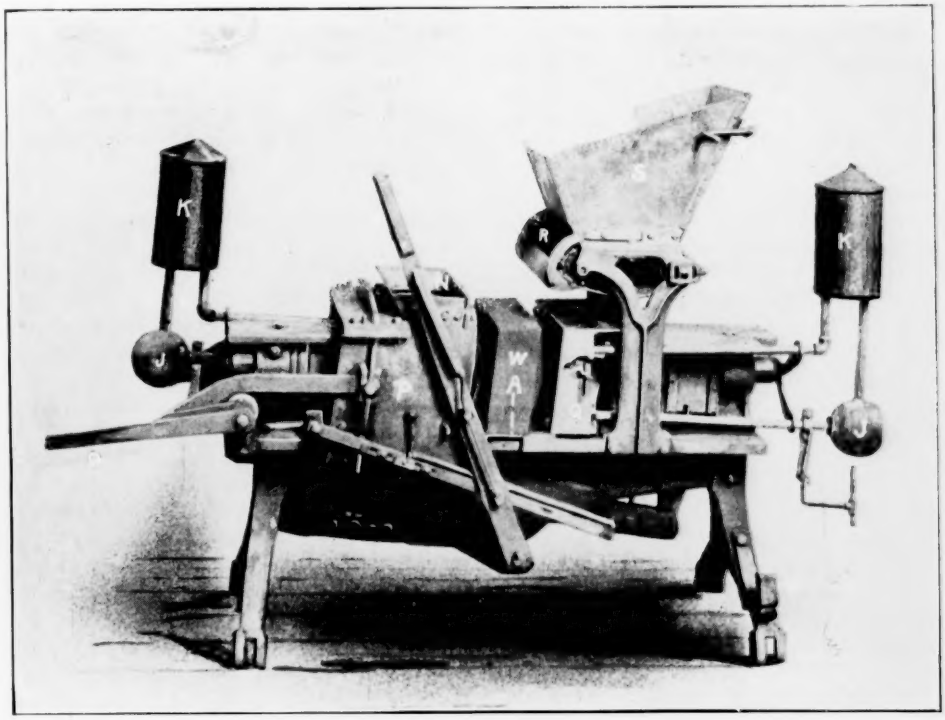


FIG. 4.

Referring to the molding machine itself, Fig. 4, the patterns are kept at the desired temperature through the medium of a hot water heating apparatus. A gas jet, H, placed underneath the hollow balls, J, heats the water in the tanks, K, and keeps up a circulation in the pipes, L, and thereby prevents that stickiness of patterns found wherever rapid molding is done. In operation the plate, A, is placed in the machine, the chill, M, is laid against the proper portion of the pattern, where it remains automatically. A small amount of sand left in the hopper, N, at the end of each operation is allowed to fall through an aperture to the bottom, where it is tucked underneath the lower corners of the chill. By raising the lever, O, the part, P, moves toward the other part of the pattern, Q, which it slightly overlaps. The hopper, N, is then underneath the outlet, R, of the large hopper, S, which connects with the sand conveyor, not shown. The operator turns the crank, T, until sufficient sand has been deposited, when by turning the lever, U, until it touches the bracket, V, bolted on the leg of the machine, the sand is compressed or rammed to the proper consistency. Reversing the levers, O and U, the patterns and flask, if it really can be called such, are removed, leaving the mold, W, and the general appearance of the machine as shown. The mold is now deposited on the conveyor, X, Fig. 3, which is of a peculiar construction. The pulley supporting the conveyor is wound by the ropes, Y Z, in such a manner that the placing of the weight of the mold there-

on, causes it to traverse a wire slightly inclined, which extends the full length of the floor. When the mold is removed from the conveyor, the motive power thereof (the mold) ceases to operate and the conveyor returns to the machine by gravity. The action of this conveyor may be said to be analogous to a clock operated by weights instead of springs, though this is the first time we have seen the principle utilized in this manner.

This company have another machine designed for the molding of mold boards for plows, and as this pattern is somewhat complicated for a machine, having a large number of lugs and drawbacks, its success on work of that character will demonstrate its utility for a wide range of foundry work.

It is said that two men can easily make five plow points a minute, or indeed five molds of any plain kind of work, and this, too, without any more severe exertion than one often sees in these days in foundries doing this class of work.

The sand is wet down, tempered and carried to a revolving wire sieve, which it goes through readily, and falls into a receiver from whence it is elevated into another one placed overhead. From there it finds its way into the molding machine through an ordinary tin pipe.

It is the intention of the Whiting Foundry Equipment Co. to adapt the machine to much of the plainer sort of work done in flasks.

Judging from the results secured thus far this rather unique departure from established methods is likely to prove quite a factor in some directions.

The Hornswoggler Cupola System.

By A. HORNSWOGGLER.

For generations the foundryman has been aware that there are serious losses attached to his business. No one can look at a cupola stack when a heat is in progress without being convinced that the majority of the heat units in the fuel are being used to increase the temperature of the surrounding atmosphere instead of being concentrated and absorbed at the proper place. When we consider that a ton of coke has sufficient heat units to melt 38 tons of iron, our common practice of melting one to 8 or 10 shows itself to be seriously at fault.

The prevailing style of cupola causes a waste of material in the first place by being built higher in order that it may take more brick to line it. I am aware that every fire brick manufacturer will be my enemy, because the Hornswoggler system reduces the amount of fire brick needed by more than one-half. However, public benefactors have always been recognized, after they are dead, and if my services in behalf of a class of people who are as poor as they are unfortunate may have the same result, I shall feel amply repaid.

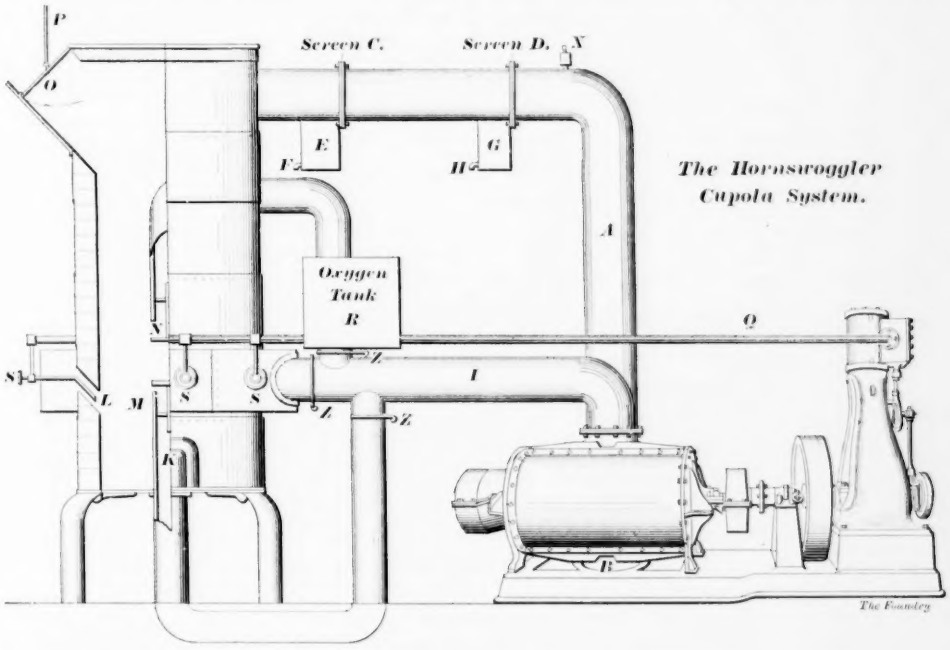
As cupolas are now constructed, a hole must be cut through the roof in order that they may protrude their ungainly features upon a suffering public. Pedestrians are continually finding cinders in their eyes, and in most cases these can be traced directly to the foundry, which should be liable for damages. Fires are recorded every week which are the result of sparks escaping from the cupola. Then the elements play havoc through the aperture surrounding the stack and a cupola shell seldom lasts more than fifty years before it has been dissolved into oxides, whereas by being kept under cover it would last more than a century.

It will therefore be seen that the economies to be effected are far-reaching. It is very difficult to describe some of the peculiar results obtained by the Hornswoggler system, because many of the elements come in contact in what is called the nascent state; that is, in the very act of separating from a body under decomposition. Referring to the illustration it will be observed that the blower secures its supply of air from the top of the cupola through the pipe, A, connecting with the intake at B. In its passage through the pipe A, the air is relieved of the cinders it contains at the screens C, D. The first screen C is of a rather coarse mesh, and is calculated to intercept unconsumed pieces of carbon, which drop into the receptacle E, from where, through the slide F, it is taken back to the platform by a belt conveyor not shown, to be charged along with pig iron deficient in carbon. Screen D is sufficiently fine to retain all of the impurities except the pulverized carbon, which is allowed to pass down to the blower, to lubricate the impellers, though if the iron is deficient in carbon plumbago may be introduced through the sight feed lubricator X. What is

retained by the screen D falls into the box G, from where it enters a conveyor through the slide H and is deposited on flat cars, to be used later in the manufacture of mineral wool, resulting in quite a saving to the foundry.

No matter how skeptical a foundryman may be, he is forced to admit that the Hornswoggler system utilizes every atom of energy generated by the fuel. By connecting blower and cupola as shown we have an endless circulation through which every unit of heat is forced to pass until it is consumed. Instead of letting seventy-five per cent of the heat escape through the stack unmolested, the Hornswoggler system causes it to be absorbed through the pipe A and returned through the pipe I, from where it is distributed to the cupola by the improved center tuyeres N K and the rapid rectilinear outside tuyere L. The latter's construction is worthy of especial study by wide awake metallurgists. It will be observed that the angle of this tuyere is such as will deliver the blast at the central part of the bottom of the cupola, provided that there is nothing in the way. By projecting the blast downwards, its temperature will increase to very nearly the point of fusion, before it can reverse its direction and reach the melting point.

Considerable economy has already been credited to the center tuyere, and the only obstacle to its universal introduction has been the fact that the cap covering the tuyere opening has been subject to the attacks of slag, through the tuyere being left open continually. The new Hornswoggler center tuyere valve M, N is constructed upon a principle which will prevent it from being clogged up. This valve closes itself automatically, when the blast pressure becomes less than ten ounces and thus prevents all of the serious annoyances to which the center tuyere has hitherto been subject. It will be noted that this cupola is provided with two center tuyeres N and K, and in explaining the purpose of this construction it is necessary to compare it with the higher sciences with which the reader may not be familiar. Therefore, if there is something said in the following lines which the reader does not understand, he should remember that this may be due to a lack of development of his appreciative organs. Briefly stated, it is known that when two currents, traveling in opposite directions, meet, there is a great heat evolved from the positive and negative energy liberated at the point of contact. Thus, if we only employ the tuyere K, the full force of the chemical reaction is not



The Hornswoggler Cupola System.

reached until the top of the cupola is reached. If we use the tuyere N only, a large portion of the dynamical force would be expended below the melting point. By securing a collision of the oxygen in the blast, so to speak, we cause a complete combustion to take place at the melting point. Another pleasing result of the duplex compound automatic hydro-dynamic tuyere is that it will be impossible for a cupola to bung up, whenever this is used, as the alternating, reverberating and consummate dynamic allotropical reducing agents keep the charge in rapid, though minute, constant agitation, based on the well-known scientific law: 4x11=44.

The charging valve O operates through a spring P and it is lined with asbestos to preserve a perfect air-tight joint. The charge is distributed by the course of gravitation on the principle of a base burning stove, and offers a relief from the usual anxiety with which a cupola is charged.

By far the most important feature of the Hornswoggler system is its combination with the Damroty principle, so called after an eminent sciologist and farmer of that name who existed in the last half of the nineteenth century. In order for Prof. Damroty to secure a reputation it became necessary for him to go to Europe, where he succeeded in increasing the national debt of several countries. Briefly stated, Prof. Damroty's deductions were that by introducing H3O into the cupola, he would form a new element in combustion, known as \$.\$.P.D.Q., the insoluble remnants of which has been found to be the most suitable material for the lining of pockets.

Everyone knows the excellent qualities of steam in separating postage stamps which adhere to each other. The penetrating influence of steam is also felt in melting, as it softens the combined carbon the same way as it softens glue on the postage stamp. It is also well known to all students of human nature, who have had occasion to handle a wheelbarrow full of mud on a cloudy day, that adhesion between their hands and the wheelbarrow is increased by spitting on the hands. The steam fulfills the mission of spitting on the blast, and causes it to remain at the melting point longer than it otherwise would.

The Hornswoggler system has greatly improved upon the original Damroty features of melting. Instead of merely introducing steam, this modern method utilizes the exhaust steam from the engine operating the blower, and conveying it through the pipe Q to the oxygen tank R, where it becomes loaded with oxygen to a point of saturation, and is then carried to the distributing valves, SSS. By regulating these valves and the blast valves ZZZ there can be seen the yellow sodium line, the red carbon line, the line to bankruptcy and other lines well known to the students of gases. Some of the gases generated by the Damroty process were so strong as to overcome the owners of the shops, while by the Hornswoggler system no ill effects are produced.

In closing the first description of the Hornswoggler system that has been given to the public we desire to call attention to the fact that everything is self contained and self evident. Every atom of heat contained in the fuel is devoured, as there is no way for it to escape, barring through the loss of friction, which is reduced to the minimum through the fine particles of graphite finding their way to every part of the machinery where lubrication is needed. From calculations made there will be no difficulty in melting 1 to 34 with this system, and after one progresses and learns how to operate the valves, this may be increased to 1 to 40. Testimonials from abroad are substantiating every claim we have made..

The Molder's Hot Spot.

By R. D. MOORE.

The designers of castings make "a plenty," but the molder often, both unconsciously and unnecessarily, adds to his losses by making more of them by bad gating.

The molder's hot spot is that part of a casting which cools last or rather sets, or ceases to be fluid, last.

That point in a casting is necessarily in the center of the body of metal and therefore the most difficult point to supply with feeding iron at the last moment.

After the feed supply has been cut off from the hottest point by the solidification of the surrounding metal, this body becomes fluid metal to itself, leaving a cavity called a shrink hole. The great majority of such shrink holes are never seen until the castings are broken up, in fact may add to its

strength, on the principle of a hollow shaft, to a certain limit, being stronger than a solid one containing the same amount of material, which is reasonable on the score of reducing the shrinkage strain.

A hot spot is necessarily produced where two parts of a casting are joined together, as when a gate is added to a pipe. A very interesting example of this is seen in cut gears, where shrink holes, if any exist, are found exactly at the point where the light arm joins the rim, which may be called an extremely delicate case, the joining arm being very light in relation to the heavy rim. Fig. 1 represents a section of a pipe with two sized gates, shown by the dotted lines, the gate A being too large with its necessary shrink blemish, and the gate B made within the safe size, and sound castings will result by its use.

The two dotted circles are given to show the great enlargement of the section, or hot spot, by the increase of the pouring gate. There is an inflexible law governing this matter, laying down a delicate line at which our license for increasing the channel must stop or we get the penalty.

A rule for pipe gating, founded on long experience may be stated thus: For a pipe ½-inch thick a gate of ordinary width, ⅜-inch is safe, ⅛-inch less than the pipe thickness. For a pipe one inch thick ¾-inch will be found safe, but if wide, in all cases, one or two eighths less will be found to be within safe bounds.

Pouring gates on the top of pipes and other castings are extremely liable to "draw" and must be reduced to about ½ inch on a casting one inch thick, which is easily accomplished by increasing the number of gates. The thin drain pipes seen all over the country have gates so thin as to be hardly distinguishable from a joint mark; they are 1-16 inch thick, and 1-8 inch thickness would probably ruin them.

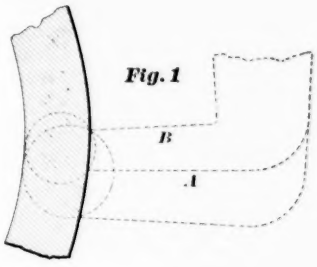


Fig. 1

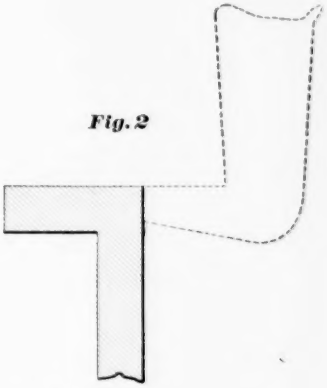


Fig. 2

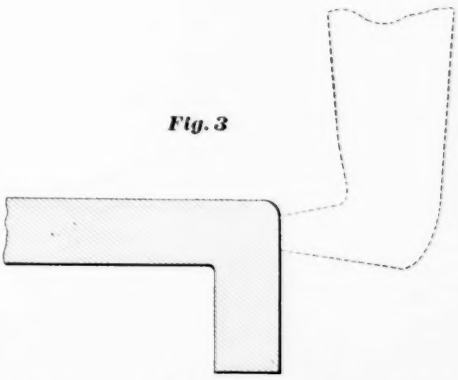


Fig. 3

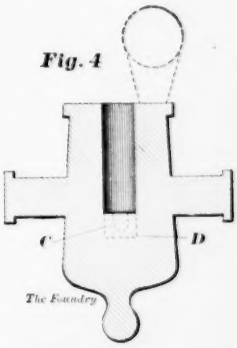


Fig. 4

Fig. 2 represents a broken section of a steam chest; a molder of considerable experience lost two of them in one heat; they had a shrink cavity running entirely through the casting at the feeder, when broken off.

I asked him what was the fault. Said he thought it was the shrinking properties of the iron. Asking him to guess again, said it might have been poured too hot.

The metal was 1⅛ inch thick, and his feeding channel was made fully 1¼ inches thick, a violation of the law stated above. The next two were fed by a gate ¾ inch thick and 2 inches wide and broke off perfectly sound. The feeding may not have continued so long, may have left a slight shrink blemish in the center of the metal, but the more essential quality of a sound skin was obtained.

As an evidence that this subject has been very generally overlooked, I will give a very recent and strong case. During last year a firm in a western city accepted a contract to make 50 flanged pipes, 8 inch bore, ⅞ inch thick. The capacity of the core oven being overrun when the patterns were ready they sublet the job to a large firm, who delivered them rapidly and good, except that a majority of the dozen pouring gates in each were blemished by shrink holes running nearly through the castings.

We have in this case at least two molders who cast them, two foremen and two proprietors, both having had long experience as practical molders, one of them giving a daily oversight of the foundry at the time, that is, six successful molders, who had an interest in the pipes, and not an effort made to correct those blemishes! They were all unacquainted with the law they violated. Some years ago the writer had charge of a shop where Louisiana sugar mills was a leading job. On account of the cheap driftwood used for fuel on the sugar plantations, they used plain cylinder boilers, with cast iron heads. I learned that many of these cast heads had been condemned from shrink blemishes occurring exactly at the point where calking of the joint must be done, the feeding gate leaving a honeycomb when broken off. These castings were 36 inches in diameter and 1¾ inches thickness of metal. The molder had been making his feeding gates by the "hap-hazard" rule, and often violated the laws of shrinkage and failed. I reduced the gate thickness from about 1⅛ inches or more to ¾ inches thick by 2½ inches wide, and of the many hundreds cast never had one rejected on account of shrink blemishes. Fig. 3 presents a section of the boiler heads with a gate of about the right proportion to the casting.

The lesson taught by these three examples bears upon a large interest in the intricate, many pointed skill called for in the molder's daily life. The essential point taught is that the pouring and feeding gates are both required to bear a certain relation, in size, at the entrance, to the thickness of the casting.

So much for the hot spots the molder can be held entirely accountable for. We have next a very peculiar and interesting case of a very hot spot for which that "other fellow," the designer, is entirely responsible for. It was a cast iron cannon, to be used by an Ohio powder company for testing the relative strength of powders they were manufacturing.

Sketch Fig. 4 presents a sectional view, which gives the points of interest, or, as Beecher would say: "its true inwardness." After casting, the piece being bored out, it was bored, then a counter chamber bored about 1¾ inches diameter and over 2 inches deep, as shown at C, Fig. 4. I was not previously aware of this chamber being part of the plan, and pronounced it impossible to make it by the usual process, because it was boring right into the vitals of a, necessarily, very hot spot, where solidity was impossible. I promised to "do better next time," and cast a solid cube about 3½ inches square, anchoring it at the end of the core as seen at D, Fig. 4, the block forming a solid body of metal for the extra powder chamber. The feeding was done at the muzzle as shown by the dotted lines, the only point at which cannon was ever fed.

Hard on the "Connersville."

A representative of the Niagara Falls (N. Y.) Gazette recently visited the Dobbie foundry at that place, and through the courtesy of Mr. J. T. Horton was allowed to load himself up with information, which he forthwith began to dispense for the edification of the Gazette's subscribers. The foundry had been turning out some six-ton columns, of which he says:

"The manufacture of one of the huge columns from start to finish is an interesting performance. First the core is made of sand and flour in the proportion of seven to one,

The core is baked hard in a core oven and then supported in the mould by the core pins. The huge 10-ton capacity foundry furnace is then lighted and the metal is soon running after the Connersville positive pressure blower, which is operated by a 25-horse power electric motor."

The unusual spectacle of a lot of metal chasing the Connersville positive pressare blower around vacant real estate must be highly amusing to the staid citizens of that part of New York.

CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and using Cast Iron. Address all Inquiries to W. J. KEEP, care of The Foundry.

TOO EXPENSIVE A MIXTURE.

"We have had complaint for some time of our castings being hard, causing great wear on tools used in facing them. The castings often contain porous spots while we want a close grained mixture. Can you suggest a cause for the trouble? We use No. 2 American Scotch, our own return and stove scrap in about equal proportions. The analysis of the casting is T. C. 3.14, Graphite 3.04, C.C. 0.10, Silicon 3.97, Phosphorus 0.612, Sulphur 0.054, Man., 0.56."

For stove plate and light hardware castings it is an advantage to have silicon as high as 3.50. When it is much above that the surface of the castings often becomes very hard, though the center will be very soft. The surface of heavier parts of a casting having 3.97 per cent of silicon will be harder than the surface of thinner parts.

The remedy in the above case is to use cheaper grades of iron. The iron which is called No. 2 is nearly a silvery iron, if it is not wholly so. By using 25 per cent of this iron, 25 per cent of good machinery scrap and the other half made up of return with sufficient stove scrap to complete the charge, the quality of the casting will be satisfactory.

No. 3 pig iron can be used in place of machinery scrap. The silicon should be reduced to about 2.75 per cent for this class of work, viz., pipe fittings, such as tees, ells, flanges, valves, etc.

This is a case which shows the difficulty experienced by the ordinary founder in using chemical analysis. He has paid out several dollars and has a complete analysis and does not know how to use it.

Everything about the mixture is exactly right, except the amount of silicon.

The first principle of foundry management is an understanding of the influence of silicon in cast iron. Ordinarily if a casting is hard an increase of silicon softens it, but after reaching 3.00 or 3.50 per cent, silicon hardens a casting. It is rare for the error to be on their side. It is well for every founder to have some quick, simple and inexpensive test which shall tell whether silicon is too high or too low, in other words, whether more or less silicon is needed.

If a test bar, one-half inch square and 12 inches long, had been made from this iron it would have had a shrinkage of about .120 of an inch, while if silicon had been 2.75 the shrinkage would have been about .150. Just as soon as the shrinkage tends up or down an increase or decrease of the soft pig iron will bring it back.

Using machinery scrap will close up the porous spots. Another reason for the use of a shop test is that the next lot of No. 2 pig iron will not have the same silicon as the last lot and the amount used must vary accordingly. A foundry mixture should never be allowed to vary enough to require a radical change, but slight changes should be made each day to keep the shrinkage uniform. Uniform shrinkage shows a uniform influence of silicon.

MOLDING TEST BARS.

I have just received a test bar one-half inch square and 12 inches long and am asked for an opinion. It broke at 503 pounds and has a very close even grain.

The iron mixture is exceptionally good and seems well suited for machine castings as the shrinkage was .157.

The sand in which this bar was made was coarse and the molder was careless and allowed grains of loose sand to fall in the mold. As a consequence the edge of the bar which was at the bottom was very rough and full of notches.

Seeing this, I intended to place the rough side up in the testing machine, but from

habit I placed it as usual in the same position as it lay in the mold.

In this case the fracture was through one of the small portions where the bar was perfect, and not through a notch as will usually happen.

If test bars are to be depended on for guidance they must be perfect. A chemical analysis would be of no value if the least inaccuracy was allowed.

In molding test bars the sand next the pattern should be as fine as brass sand or as No. 1 stove plate sand.

A smooth casting is stronger than one that is rough, because the uneven surface acts the same as a notch on one corner. The surface and corners, therefore, should be smooth and free from all imperfections. The test bar should be as near as is possible the same size as the pattern, and to make it unnecessary to mend the mold the parting on the follow-board should be perfect. It is best to have two square test bars in one mold and to make two molds. This gives the average strength of four bars and the shrinkage can be measured on one of them. A careful molder will never have a defective test bar.

The test bar should be placed in the testing machine in the same position as it lay in the mold, because as the iron entered the mold the impurities which floated in the fluid iron and small bubbles of gas would rise to the top of the test bar, and would not influence the strength if tested in the same position. This is one of the reasons why the transverse test is best for cast iron.

Another reason is that the lower surface of a test bar will be slightly flat while the upper surface will be slightly concave, on account of the shrinkage of the metal. If tested top down the stress would come on the corners which would be lower than the center of the surface. As it is most convenient to mold a test bar with one corner down there will be two perfect sides, but the same side must always be placed down, therefore the lower side is always the side to which the gate is attached.

Thousands Agree With Him.

I could not afford to be without THE FOUNDRY. CHAS. ALAND,
Foreman West Shore Foundry,
Frankfort, N. Y.

CHEMISTRY IN FOUNDRY PRACTICE

We have arranged with Mr. S. S. Knight to answer such questions as relate solely to Chemistry in Foundry Practice. Our readers are invited to send us queries relating thereto.—Ed.

TWO ALLOYS OF IRON.

So many views have been expressed upon the result of mixing or alloying commercial pig iron or scrap or mixture of both with aluminum, and so many experiments recorded showing what the effect of such action had been that it seemed superfluous to say any more on this subject. However, so much has appeared of either a misleading character or of a wholly incorrect nature, that the writer feels justified in calling attention to some experiments that he performed.

Some time since an article appeared in one of the leading trade journals, in which it was stated that if the percentage of aluminum should be increased to over two per cent of the total weight, that the shrinkage of such metal would be much less than that of the same iron, but without the aluminum. The same author also observed that the tendency of aluminum was to change the combined carbon to graphite and thus diminish the tendency to chill.

In order to demonstrate the truth in this matter five series of tests were made. In each test four bars were made for transverse breaking and two tensile bars to correspond with each dead-load bar. The bars were marked as follows: those containing aluminum, A; those containing ferro-manganese, B; those containing both ferro-manganese and aluminum, C; and those poured without anything added, D. Careful analyses were made upon every set of bars in each series. Each tensile bar had a section of one square inch and the transverse bars were made approximately 2″x1″ and broken on supports 24″ apart, the load being applied 12″ from each of these.

SERIES I.

	Def.	Tensile strength.	Measurements.	Tran. strength.
A....	.40″	20,000 and 20,500	.958″x1.961″	2,364
B....	.43″	23,000 and 24,000	.992″x1.953″	2,452
C....	.35″	22,000 and 21,800	.932″x1.953″	2,394
D....	.41″	20,000 and 21,100	.962″x2.008″	2,303

In bars B and C enough ferro-manganese was added to make the iron flash strongly, and in bars A and C enough aluminum was added to make its percentage of the total weight approximately three-tenths of one per cent. It was observed that after the aluminum was added, that the metal lost its life very rapidly and became viscous at a much higher temperature than the iron to which nothing was added or that alloyed with ferro-manganese. The partial analysis of each bar is given below:

SERIES I.

	A.	B.	C.	D.
Silicon	1.56%	1.60%	1.58%	1.54%
Sulphur	.010%	.010%	.010%	.010%
Phosphorus	.66%	.65%	.66%	.66%
Manganese	.55%	1.11%	1.20%	.57%
Com. carbon	.37%	.40%	.42%	.35%
Graphite	2.96%	2.66%	2.69%	2.98%
Aluminum	.31%		.33%	

The lower end of each bar rested upon a chill-plate. It was noticed that A chilled deepest, C next, while very little difference could be seen between B and D. Of the four bars, A and C both pulled off the upper head in cooling, while the shrinkage in B was greater than in D. The reader will please observe that with the addition of three-tenths of one per cent of aluminum both chill and shrinkage are very largely augmented.

The next series of bars were cast from a softer mixture of iron and while the metal was very hot. The coke had been purposely increased to raise the temperature of the iron and a blast pressure of twelve ounces was maintained throughout the melting.

The metal also came from the last of the heat just before the bottom of the cupola was dropped.

The bars broke as follows:

	Def.	Tensile strength.	Measurements.	Trans. strength.
A....	.35″	20,000 and 20,000	.982″x1.950″	1,968
B....	.45″	23,000 and 23,000	.965″x1.966″	2,108
C.....	.35″	24,000 and 21,000	.963″x1.950″	2,212
D....	.45″	22,000 and 23,000	.942″x1.952″	2,200

These bars were made approximately the same size as in the preceding series and broken in the same manner. In casting them it was noticed that the iron containing aluminum solidified at a much higher temperature than that without it. The metal seemed perfectly homogeneous in the ladle, but in casting bars A and C a white substance was seen to rise and turn irridescent as the metal cooled. These bars both showed shrinkage action as in Series I, and seemed to have a tendency to chill even in sand molds. The metal was very close and sharply rang when struck with a steel hammer, thus indicating high combined carbon. Bars B and C had the same percentage of ferro-manganese added as the corresponding bar in Series I. They showed very little evidence of chill even on the end next to the plate and did not shrink abnormally. This metal was held in the ladle until all flashing had ceased and then poured.

The effect of this on the strength of the bar is very noticeable. This accounts for its comparatively low breaking strain and also for the small amount of manganese shown in the following analysis, although ferro-manganese was added. Bar D was poured at the initial temperature of the metal and bar C after a slight flashing had taken place, the aluminum having been added previous to the ferro-manganese.

The analysis proved most interesting and was as follows:

SERIES II.

	A.	B.	C.	D.
Silicon	1.901%	1.871%	1.880%	1.910%
Sulphur	.020%	.021%	.021%	.023%
Phosphorus ...	.764%	.769%	.758%	.770%
Manganese	.50 %	.83 %	1.15 %	.52 %
Comb. carbon..	.36 %	.42 %	.41 %	.33 %
Graphite	2.93 %	2.75 %	2.89 %	3.09 %
Aluminum	.42 %		.40 %	

Of all the bars, C had the closest grain and was the easiest drilled. It is to be regretted that no means was at hand to accurately measure the softness of the metal, as this record might help much in determining the actual structure of the several bars. Sections were, however, examined with the microscope and the polyhedra seen in bar C were of the well-known hexagonal type. After treatment with diluted nitric acid the particles of ferrite appeared as elevations, the depressions showing where the aluminum had been.

In the third series of bars, the aim was to have every condition as favorable for making the iron strong as possible excepting the composition of the metal. This was intentionally made as weak as possible, high phosphorus and high sulphur irons being used. It will be noticed that the action of ferro-

manganese shows very plainly in B, while bar A demonstrates the inability of aluminum to strengthen poor, weak metal even when used in percentages that would make such mixtures far from economical even if they possessed all of the virtues so often claimed for them. The following record will show exactly the advantage of using both aluminum and ferro-manganese in this kind of material:

SERIES III.

	Def.	Tensile strength.	Measurements.	Trans. strength.
A....	.35″	20,000 and 21,000	.995″x1.975″	1,811
B....	.40″	22,000 and 23,000	.982″x1.990″	2,160
C.....	.30″	21,000 and 19,000	.982 x1.992″	1,962
D....	.35″	21,000 and 21,000	.963″x1.987″	1,761

In connection with the above should be noted that in but very few cases has ferro-manganese acted with great power towards increasing the transverse strength of materials that carried over one per cent of phosphorus.

The above case seems, therefore, an exception to a general rule, but it must be remembered that all conditions were purposely made favorable to its metal. The iron was very hot and remarkably free from slag. The analysis which follows will give some idea as to the actual composition of each bar:

SERIES III.

	A.	B.	C.	D.
Silicon	1.558%	1.577%	1.690%	1.544%
Sulphur	.047%	.040%	.050%	.050%
Phosphorus ...	1.204%	1.208%	1.212%	1.216%
Manganese	.612%	1.220%	1.017%	.650%
Comb. carbon..	.526%	.611%	.600%	.542%
Graphite	2.715%	2.791%	2.700%	2.806%
Aluminum	.52 %		.566%	

The last two sets of bars were cast to show the difference in the influence of manganese and aluminum when used in the same proportion. The first set of these bars is shown in the accompanying table under Series IV.

SERIES IV.

	Def.	Tensile strength.	Measurements.	Trans. strength.
A....	.35″	20,000 and 20,500	.975″x2.008″	2,054
B....	.35″	22,000 and 23,000	.978″x1.980″	2,090
C.....	.30″	24,000 and 22,000	.985″x1.970″	1,852
D....	.40″	22,000 and 22,500	.998″x1.981″	2,025

The iron was hot and clean and all bars were poured as nearly simultaneously as possible. In B and C where ferro-manganese was used the iron was held until it flashed strongly, showing that the reheating was taking place. In bars A and C one thing was most strikingly noticeable, and that was after the bars were poured, although the aluminum was very thoroughly stirred in, a sheet of it rose to the top and formed a crust there upon the top of the iron. This will be remembered as it will be referred to again.

The analysis was as follows:

SERIES IV.

	A.	B.	C.	D.
Silicon	2.085%	1.990%	2.109%	1.983%
Sulphur	.016%	.016%	.016%	.016%
Phosphorus	.672%	.654%	.660%	.666%
Manganese	.320%	1.181%	1.200%	.400%
Comb. carbon..	.370%	.405%	.400%	.321%
Graphite	2.808%	2.792%	2.670%	2.980%
Aluminum	1.10 %		1.150%	

On account of the tendency of the aluminum to separate itself from the iron in a great degree, another series was determined upon, the purpose being to introduce about two per cent of the metal into the iron in the ladle. The following bars resulted.

SERIES V.

	Def.	Tensile strength.	Measurements.	Trans. strength.
A....	.48″	22,000 and 21,500	.960″x1.955″	2,080
B....	.45″	25,000 and 24,500	.948″x1.952″	2,462
C.....	.35″	22,000 and 22,000	.970″x1.970″	1,881
D....	.45″	20,000 and 21,000	.965″x1.955″	1,965

Glancing over the bars given there seems to be some things shown that have not been heretofore generally accepted. Thus in most cases where aluminum alone was used regardless of the proportion, the strength, either tensile or transverse, was not perceptibly increased, although the deflection was often reduced over 10 per cent. In every case but one (Series II.) the addition of ferro-manganese increased the transverse strength without decreasing the deflection.

All bars in which aluminum was used showed a decided tendency to chill and possessed a faulty structure, in many cases blow-holes of some size being present. On the other hand, in the metal to which the ferro-manganese was added no blow-holes

were seen nor any sign of excessive chill, although the shrinkage of the metal was slightly augmented. In many cases where the two alloys were mixed the aluminum destroyed the effect of the ferro-manganese so that its tendency to increase the transverse strength of the metal cannot be seen in all bars marked C. However, these bars did not chill as readily as those containing aluminum alone, so that in this one particular, the effect of the manganese was not lost.

In connection with bars A and C the last analysis will be worth noticing.

SERIES V.

	A.	B.	C	D.
Silicon	1.800%	1.755%	1.776%	1.820%
Sulphur	.022%	.024%	.022%	.022%
Phosphorus ...	.842%	.850%	.840%	.871%
Manganese	.540%	1.661%	1.555%	.550%
Comb. carbon..	.388%	.453%	.460%	.345%
Graphite	2.701%	2.640%	2.636%	2.838%
Aluminum	1.505%		1.484%	

It will be remembered that two per cent of the aluminum was what was added to the ladle, yet our analysis shows barely one and one-half per cent. On bars A and C the same rise of aluminum was noticed as was spoken of before, but in this case much more of the metal was thrown out.

It seems only logical from the foregoing experiments that if the metal could be held long enough in a liquid state after the aluminum is added, that in every case regardless of the initial addition, that the amount of this metal would remain constant, providing that more than this constant quantity had been added. Such a state of affairs would be almost identical with the well-known phenomena of solubility of the ordinary salts in our common liquids. Thus at a certain temperature so much water will hold in solution so much salt and no more. Would it not be reasonable that liquid iron should have a saturation point in the solution of not only aluminum, but also of other metals.

Before concluding, the author wishes to briefly answer a few of the criticisms that have been made upon his work.

One reader asks why the term reheat has been used in speaking of the action of ferro-manganese on iron. It is often hard to account for the indiscreet use of words in describing any observed fact. However, any one who has added pulverized ferro-manganese to a ladle of molten iron could not have failed to notice that after a certain quantity has been stirred into the metal, and a sufficient time elapsed, that the surface of the iron assumes a sharp and distinct glow, which seems to originate at certain points and spread toward the sides of the ladle much in the same way as ripples travel when a stone is thrown into a bucket of water. This glowing is nothing more than the burning of the manganese where it comes in contact with the air. Now if the metal be stirred this flashing will take place much more rapidly since more of the manganese will come into contact with the atmospheric oxygen under these circumstances than before. Hence the use of the term "reheat." After all it does not seem that this is a misuse of the word, for would not the combustion of the manganese furnish additional calories, and hence increase the temperature? The process would not only be analogous to that which takes place in a Bessemer converter, but would be identical as far as the manganese and its action were concerned.

In the September FOUNDRY Dr. Moldenke suggested the application of Le Chatelier's electric pyrometer to an experiment tending to show the actual amount of heat, in absolute heat units, consumed or rendered latent in rearburizing a sample of soft pig iron. In order to do this and have the experiment successful two bars would have to be cast of exactly the same size and shape and chemically homogeneous in everything except the carbons. The bars would have to be of such dimensions that the one cast in the chill should be chilled throughout. Now granting that such bars could be cast, the next necessity would be a source of heat which would produce a constant number of heat units per unit of time, and the slightest deviation from its standard heating capacity would of course render the experiment of no value. The doctor will see at once the impossibility of such conditions while producing such very high temperatures. Then the loss of heat by radiation and convection would have to be accurately calculated. Hence it is very easy to see that in any experiment where so many chances of error existed that but very little satisfaction could be obtained by its performance. In considering this matter it must be remembered that the very best apparatus in the hands of a

well trained scientist will give a variation of from seven to ten degrees centigrade at a temperature of less than 1,000° C. It may therefore easily be seen how impractical is the suggestion of Dr. Moldenke, and how unable any man is to make such an experiment satisfactorily at this time.

One other thing that will bear reviewing—Mr. Putnam's article upon the "Chemistry Fad." One would hardly expect such an article from him, as he has always heretofore advocated the application of scientific knowledge to industrial work. However, it should be borne in mind that the individual who "swallows everything whole" in the intellectual world will as surely be troubled with mental nausea and dyspepsia, as his counterpart in the physical world will be aggravated with the corresponding disease.

The author well understands that it is considered au fait to belittle technical, scientific knowledge whenever it oversteps its boundaries and comes from the college laboratory into practical everyday life. This, no doubt, is largely the result of the employment of men who can run through the chemical catalogue with the greatest non chalant, and who therefore call themselves chemists, and not only seek, but ofttimes find employment as such. It may be that Mr. Putnam has had some experience along this line, and if so his article can be easily explained. But it should be remembered that the enormous strides which the foundry business has taken in the immediate past has been wholly due to scientific training when used in connection with common sense and active industry.

CORRESPONDENCE.

OBTAINING CHILLED CASTINGS WITHOUT A CHILL.

We are engaged in making plows and are looking for a mixture of iron that will give us mold boards as hard as chilled boards without the use of chills. Should like to hear from the readers of THE FOUNDRY on this subject. C. A. W.

Editor THE FOUNDRY:

We will shortly erect a new foundry, and are trying to determine as to what would be the best construction. Foundry will be about 450 feet long and 150 feet wide. It will be used for making all green sand work, and most pieces will be handled by a crane, we think a number of jib cranes. A good many cauldrons and large kettles and similar work will be made requiring, we should judge, from three to five-ton cranes. What style of crane do you think will be most suitable, steam, electric, air or hand power cranes? Would you advise iron or wood rafters to support roof? Wouldn't iron rafters require frequent painting to prevent rusting occasioned by the great condensation that takes place in a foundry every evening? What style of roof would be the best and most economical in the end? How would be the best way to arrange skylights? If you can furnish us with any information as to how a thoroughly modern foundry should be built, or if you will, we would like for you to have some of the many readers of THE FOUNDRY answer some of these questions.

B. & S.

Wonders Never Cease.

The Boston Journal of Commerce has discovered that "the addition of from two to five pounds of aluminum to a ton of iron renders it grayer and softer, the slag rising rapidly and completely to the surface, and leaving the metal in a far purer and better condition than before. In this case, too, the iron is more fluid in the ladle and can be poured into small molds without any tendency to chill, and the formation of 'waster' castings, due to blow-holes, is entirely avoided."

The only trouble the Journal will have in introducing aluminum will be in making the foundrymen pay for it. The price of five pounds of aluminum added to the cost of a ton of iron makes quite a difference, which the consumer is not likely to be willing to pay for, at least not as long as he can obtain good castings in other ways.

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Trade Outlook.

Although this is the season of the year when a temporary dullness is always expected, a greater share of foundries are operating their shops than in former years. This would indicate that the usual period for stock-taking and overhauling of plants will be somewhat reduced and shops started earlier in the new year than anticipated.

If consumption keeps up at the present rate, prices are reasonably sure of being maintained if not increased. Reports of new orders being placed for railway equipment of all kinds are numerous. When it is considered that many of the roads are unable to provide transportation, owing to a lack of cars, there is reason to expect that shops engaged in supplying their wants will be fairly busy for some time to come.

Taking everything into consideration, this coming year may be regarded with greater confidence than any of its immediate predecessors.

A Wrong Conception.

A writer comparing the manufacture of steel and cast iron castings says that shrink holes in the latter are prevented by "having an opening under the casting filled up with hot iron, which is kept fluid longer than the casting by stirring it." Just how the metal is kept fluid by stirring is not explained, doubtless because the author never undertook to keep metal fluid in that manner. Every foundryman knows that metal will lose its fluidity in a much shorter time if agitated than if allowed to remain undisturbed. The mere tilting of a ladle from one position to another will speedily reduce the temperature of the metal. The introduction of a feeding rod and the agitation produced thereby, instead of tending to keep the metal fluid has the opposite effect. The object of using the feeding rod is but vaguely understood by many. By its aid a channel is kept open to the heaviest part of the casting, through parts having a smaller cross sectional area. Thus through a comparatively small riser a large casting may be supplied with metal required to fill the space caused by the shrinkage. The feeding rod does not keep the metal fluid nor does it force an atom thereof into the casting. It merely provides a channel to the interior of the casting on the same principle that a

hole may be kept open in a freezing body of water by agitation.

By providing sinking heads having as great a cross sectional area as the heaviest part of the casting and placing these directly on those parts the necessity for using the feeding rod would be obviated. But this would largely mar the appearance of the casting owing to the large surface which would have to be chipped over, and to reduce this to the minimum we use a smaller feeding head and utilize the feeding rod to maintain a connection between this and the heavier part of the casting until the latter has solidified.

Foreign Sidelights.

A paper read by Dr. Wuest at the annual meeting of the German Foundrymen's Association, held at Goslar, Germany, September 16, has been translated by a few trade journals, whose solicitude to advance the American foundrymen to a better position, is well known. Dr. Wuest spoke of the relation between pig iron values and its scrap carrying qualities and said that at present there was a difference in the price of No. 1 and No. 3 irons amounting to $1.63 per ton. This appears to be a greater difference than exists on this side, as a reference to the market reports of the journals publishing this paper, shows a variation of from 40 to 90 cents per ton in price between No. 1 and No. 3 irons.

The author says: "Too much stress is usually laid upon the presence of the carbon in the pig iron in contradistinction to the silicon. It is quite certain, provided there is not too much silicon present, that any lack of carbon is made good from the fuel, while remelting in the cupola. The fluid iron will dissolve the carbon while flowing over the incandescent coke, just as eagerly as water will dissolve sugar. We may be certain, therefore, that no charge will come out of the cupola below 3 per cent in carbon. Even if steel scrap is remelted in the cupola the carbon will approximate 3 per cent, which means that the steel has been converted into cast iron. This 3 per cent of carbon is sufficiently large to allow a separation of graphite, provided enough silicon be present. On the other hand, it is rather an advantage to have the carbon not over 3.5 per cent, when sound, fine-grained and tough castings are to be produced, especially when the sections are heavy; otherwise the castings will be too soft, weak, and have dirty surfaces owing to the formation of kish. The question of the carbon contents, therefore, can usually be overlooked."

It will be refreshing news to many foundrymen to learn that the carbon contents can usually be overlooked. As bearing directly on this point we quote from "Cast Iron Notes" in THE FOUNDRY for September, 1886. Mr. Keep was asked the following question: "You speak of the difficulty in mixing iron by chemical analysis of silicon on account of the variation in carbon and because the percentage of silicon needed depends upon the percentage of carbon present. Do you not think that iron will take up, in the process of melting in the cupola in contact with the fuel, all the carbon which it would naturally absorb? The iron descends in finely divided streams through fuel rich in carbon. It has been found that 1 per cent of carbon can be added to soft steel by the Darby process."

In answering Mr. Keep said: The amount of carbon that will be absorbed is inversely as the speed at which the ore descends. The greater heat, the more carbon will be absorbed. For an iron to be high in carbon the furnace must be hot and the iron sponge must remain in contact with the carbonic acid gas a sufficient length of time. The sponge does not absorb carbon by being in contact with fuel but by contact with the gas produced by the combustion of fuel. * * * After the sponge reaches a point where the heat is sufficient to melt it, there will be no increase of carbon. * * * The iron in the furnace does not absorb carbon while it is melting and neither does it do so in the cupola. In the cupola the melted drops are not in contact with the fuel to any great extent and the passage into the hearth is very rapid. This is not similar to the Darby process, which takes melted iron from which all carbon has been removed and which therefore has a very strong affinity for carbon. He adds finely powdered coke to such metal and it absorbs instantly 1 per cent of carbon. Iron in contact with powdered carbon at a temperature that will melt iron cannot absorb much more than 2 per cent of carbon. This

is, therefore, the saturation of such iron with carbon at such a temperature and if an iron containing more carbon than 2 per cent is melted in contact with powdered carbon it could not absorb more. Iron to be fit for foundry purposes must contain more than this and generally contains about 3 per cent. Gray pig iron, therefore, loses carbon in being melted and cannot, in any way be made to increase it. I spoke of the irregularity of carbon in pig iron and said that a given percentage of silicon would not be as effective with low carbon as with high to show that controlling a foundry mixture by analysis of silicon would not give castings of uniform quality."

In view of the foregoing we are rather undecided about accepting Dr. Wuest's declaration, that the carbon can be overlooked. And to show that we have the support in this contention, not only of those who favor a physical test but those who favor chemistry as well, we quote from Mr. S. S. Knight in THE FOUNDRY, November, 1896:

"In considering the amount of silicon a mixture should contain the carbon should also not be neglected. An iron containing 3 per cent of silicon and 4 per cent total carbon is worth more than a hundred with 4 per cent of silicon and 2 per cent carbon. Silicon without carbon is worthless to decrease shrinkage, silicon with carbon in the presence of manganese and titanium in any quantity is worse for the same purpose.

Dr. Wuest continues: "In addition to the silicon contents and the rate of cooling, the percentage of manganese present has an influence on the condition of the carbon. Manganese prevents the separation of graphite, the carbon remaining in the combined form when the iron has cooled, the natural consequence being that the castings are hard and brittle. Whether 1 per cent of manganese in an iron has a distinctive hardening effect is not certain, but 0.7 to 0.8 per cent in the finished casting will not be found detrimental. A little higher manganese is desirable in the pig iron because in burning out during remelting and going into the slag, it protects the silicon of the pig iron. Consequently of two brands of pig iron having the same silicon but varying in manganese, the richer one can be remelted in the cupola oftener before becoming a white iron. Moreover, a high percentage of manganese is a guarantee of low sulphur, a high manganese iron always being low in sulphur, as the manganese unites with sulphur to form a sulphide of manganese, which being insoluble in iron goes into the slag. The scabs often seen on castings owe their origin to this reaction. It seems to me, moreover, that in remelting a high manganese iron in the cupola, much less sulphur is taken up from the coke than would be the case with an iron low in manganese. Either the sulphur goes into the slag of the cupola as sulphide of manganese, or a process of purification based upon the manganese contents of the iron takes place in the ladle. The effect of the sulphur on the brittleness of the castings can be best seen where no limestone has been charged, the first four ladles taking up an excessive amount of sulphur from the coke bed. Under normal conditions, however, the sulphur in pig iron is so low, and can be kept thus by suitable precautions, such as high grade coke, plenty of limestone, additions of manganese, care in remelting, etc., that a hardening effect cannot be noticed."

It will be welcome news to our molders that scabs are ever caused by the manganese uniting with the sulphur. We should like to know, however, why this "reaction" is delayed until the metal is in the mold, instead of taking place in the hearth of the cupola or in the ladle. We are afraid that the molder who should attempt to explain the phenomena of a scab, as being due to the fact that the manganese and sulphur failed to react on time, would be liable to find a certain active reaction against himself. With all regard to Dr. Wuest for his good intentions we do not think such an excuse would be accepted here. Such things used to go but they don't go now.

Concerning sulphur, Mr. Knight says in THE FOUNDRY, January, 1897: Little has been written on the elimination of this element from iron. Many experiments have been tried, but all that have come under the author's notice were most unpromising in their results. It seems safe to consider as approximate truth that every time the metal is fused an increase of sulphur is sure to take place. The amount of increase is, of course directly proportionate to the amount of sulphur in the fuel.

It would seem that Mr. Knight had failed to experiment with manganese. If we can afford to ignore the effect of sulphur, we will have taken a long step forward. The question to be decided is whether high-grade coke, plenty of limestone and additions of manganese, care in remelting, etc., does not cost more than the market price of castings will allow.

Concerning the effect of green sand molds Dr. Wuest says:

The liquid metal must not only heat the sand but drive out the moisture necessary to pack the sand properly. * * * The moisture of well-cut molding sand varies between the narrow limits of 7 to 10 per cent, consequently in order to dry 100 pounds of sand, 10 pounds of water must be evaporated. This heat is taken suddenly from the metal and accounts for the increased shrinkage due to green sand when compared with dry sand or loam.

If Dr. Wuest's contention that the evaporation of the full amount of moisture takes place suddenly is correct, castings would cool a great deal faster than they do. The fact of the matter is, that except a casting be left in the mold an abnormal length of time the mold will not be dried out, except in close proximity to the casting. The amount of evaporation which takes place is entirely problematical, as condensation takes place before the steam can reach the surface of the mold and escape. One thing is sure, however, that the heat required to evaporate the water in the mold is not taken from the iron suddenly, but gradually.

The statement that "manganese should not go beyond 0.8 per cent, otherwise it would make the casting hard" is somewhat difficult to reconcile with former assertions by the author that manganese protected the silicon and absorbed the sulphur. From 120 castings of different kinds analyzed by Dr. Wuest for silicon and manganese contents, he furnishes the following table as to the amount of silicon a casting of a certain thickness should contain:

Castings of a thickness below 0.4 in. require 2.5 to 2.8 per cent silicon; castings of a thickness between 0.4 and 0.8 in. require 2.1 to 2.3 per cent silicon; castings of a thickness between 0.9 and 1.2 in. require 1.9 to 2.1 per cent silicon; castings of a thickness between 1.2 and 1.6 in. require 1.7 to 1.9 per cent silicon; castings of a thickness of 1.8 in. and over require 1.5 to 1.7 per cent silicon.

Dr. Wuest leaves the impression that no casting should contain more than 2.8 per cent of silicon nor less than 1.5 per cent. For very light castings silicon may be run up to 3.50 per cent and there is much heavy work, where less than 1.5 per cent of silicon will suffice.

Dr. Wuest's table of silicon contents savors somewhat of a cooking recipe, and may appear valuable to the uninitiated, but as the amount of silicon needed depends upon the amount of other elements present, such as carbon, sulphur, titanium, etc, hard and fast rules of this kind are absolutely valueless. A close study of the table containing the analysis made by the author will show this to be the case. Thus we find that analysis No. 3 of a radiator casting having a thickness of 1-4, 4-5 and 1-10 inch and containing 1.93 per cent of silicon and 0.96 per cent of manganese is classed as somewhat hard because it contains too much silicon and manganese. Further on No. 23, one-half inch thick, containing 2.54 per cent of silicon and 0.50 per cent of manganese is alluded to as being hard. This is in direct contradiction to the rules established by the author and a casual glance at the one hundred and twenty analyses show more than forty inconsistencies of the same character. No matter how honestly researches are made the attempt to formulate rules of this kind will not contain the key to problems that are continually arising in the making of mixtures. Without taking into consideration more than a few of the elements contained in the iron, deductions as to the value thereof are half guessing. There can be no fixed relation between the thickness of a casting and its silicon contents unless all the elements existing in the iron are taken into consideration, which has not been done in the paper under discussion.

The man who talks about low prices has generally had a hand in making them.

Some foremen would be thought more of if they would throw up their job and let their employers learn a few things by experience.

Krank's Korner.

Looking back over musty recollections of the bad castings we have turned out, the silent ghosts of a few of these are labeled: "Faulty Coreprints." Don't slam the paper down and say there is enough of molder's excuses without inventing any more, because there is nothing new about this, it is simply an old ailment, epidemic in some places, that needs a little light shed on it, to dispel the foggy idea that a coreprint should be made of whatever loose scrap the patternmaker happens to have around.

* * *

There is a right and a wrong way of making coreprints. We have seen some notes in regard to standard prints and admit the beauty of such a thing where interchangeability is desired, as, for instance, in a set of pulley patterns, where new combinations are called for every hour. It is about as difficult to introduce standards into the foundry as it is to secure subscribers for a prohibition paper and get them to pay for it. If we had more standards we would have less bad castings, and also be minus a good deal of experience that every failure brings; so while we don't want to be considered as being opposed to standard coreprints, wherever practicable, still we contend that a coreprint should be made to suit the conditions under which the casting is to be made, believing that in this way a great many annoyances may be averted.

* * *

Climb upstairs where the patterns are kept and just count how many have coreprints that were made with some regard for its use in the foundry. Maybe you will find one and that was made by accident. Here is one with a small sliver nailed on to support a heavy core, while its neighbor is more print than anything else, requiring a flask twice as large as it ought to. Don't you think a little more attention to coreprints would pay? Don't say a word to the patternmaker, he is innocent, for you never say a word to him as to how you want it done, or give a reason for him to look this matter up.

* * *

Draft is not the only thing needed on a coreprint. Under ordinary conditions you can get along with a much smaller print for either dry sand or loam than for green sand work, though in the latter case you can reduce the area for print almost as much by providing bearings in the flask to carry the weight of the core and support it against its tendency to float, which is in most cases a much greater force to provide against than the mere weight of the core is exerting.

The tendency is not so much to do more work as it is to make every blow count. Some lines of foundry work have almost been revolutionized by dropping wasted operations. A large coreprint means a large flask and a greater amount of sand to handle; it means the expenditure of muscular energy that simply produces nothing and a corresponding increase of cost. There is something pitiable about the sight of a molder wearing himself out working hard and nothing to show for it at night.

The whole mechanical world is busily engaged in clipping off seconds in all operations. The foundry has hesitated about accepting a second as a space of time worth any consideration; it has always shunned anything infinitesimal; but in this age of iconoclasm we may with safety assail practices that have no other foundation than antiquarian usage. About as good a place as we can point out in the general run of foundries to gain a second is right around the coreprints of their patterns.

Pokey's Pointers.

"No use talking, somebody is always getting ahead of us," said Pokey the other morning, as he came into the foundry to relieve himself of an overdose of biliousness.

"And it doesn't matter much what you do," he continued. "First one and then another will find it out and go you one better. Here we used to be making cores with flour, then we changed to the Novent core compound and now the Enterprise not only uses the same thing to keep even with us, but they go us one better and thin it down with clay wash. Muggins took their foreman over to a place where it says "PUSH" on the door and in running off a heat there some of the up-to-date gases, caused by the combination of several unknown mixtures, nearly choked Muggins with emotion, when he considered how far we are behind in running our foundry. We ain't saving enough, Tom, do you know that?"

"This saving business is getting to be a darned nuisance all right enough," said

Tom. "Nobody dares to open his mouth unless he has a yard of statistics to show his pedigree as a saver. And what do they save? Well here is the Enterprise saving core compound, as you say, by using clay wash. That same material has been used for years to save flour. But come to think of it clay wash costs something, too. It takes time to mix it, but suppose we say that it costs nothing, what does the Enterprise save?"

"About twenty-five per cent of core compound, as near as Muggins could find out," answered Pokey.

"Just so," admitted Tom. "They save compound but do they save any money? By using clay wash they close up the pores in the sand, and when they lose a casting because the core blows, it seems to me that this ought to be charged up against the clay-wash. The Enterprise foreman simply told Muggins what he saved in core compound, but he never mentioned what he lost in bad castings. He didn't say he saved money, which I know he didn't, just core compound."

"Well, it is pretty hard to get ahead of you, Tom, but I am going to corner you. Here is the Eureka, run a shop like our own, get along with two carloads of sand a year. We use ten. I know that is all they got, because the railroad company's books show it. What have you got to say for yourself there? Probably you have got an extra man around the shop just to wheel out our money. Might as well lay him off. Mac's prosperity ain't going to be so thick but that we can cut our way through it. Now own up that the Eureka are running their shop with less sand than we are our's. They know how to save better than we do, don't they?" asked Pokey.

"Yes, I guess your figures are right. They beat us in saving sand," acknowledged Tom.

"I thought the evidence would be too strong against you to dispute me, Tom. Now, why can't we do the same thing?"

"We can, just as well as not."

"Well you are a cool cucumber to tell me that we can do it just as well as not. Why didn't you do it long ago? What in the devil do you suppose I hire a foreman for anyhow? To spend my money, it looks like. Guess I had better get it changed into Mexican dollars so it will last longer. I don't know what I would do if the machine shop was run on the same basis as the foundry. When you see other people making a saving why in thunder don't you do the same, Tom?"

"Thought it better not to," answered Tom.

"Thought it better not to, hey? Thought you were working for a millionaire anyhow, and might as well blow in his money so he couldn't leave any to found a home for old maids, did you? I want you to know that I haven't got more money than I know what to do with."

"You want me to save sand, do you?" asked Tom.

"Of course, I do. Want you to save anything you can. Sand, coke or anything else, no matter what it is."

"Thought you wanted to save money," suggested Tom.

"Now don't cause me to forget that I am a Christian. Such a question? Thought I wanted to save money. Ain't sand money? Do you think the railroad company hauls it here for nothing? Sand is money, and you know it."

"I know sand is money, even if I ain't a free silver man," said Tom. "But if sand is money, there is a wide difference between saving sand and saving money."

"Now, you ain't the seventh son of an Egyptian and you needn't try to bamboozle me with any of your sleight of hand or second sight illusions," cautioned Pokey. "Money ain't sand but sand is money, and I want you to go easy on the sand pile,

"All right," said Tom. "I will follow the Eureka's example. Their sand heaps are like ashes. Can't ram up nothing without having the flask full of gaggers, soldiers and nails. Where they save five cents' worth of sand they lose a quarter's worth of time in securing the burnt out stuff they have got. I will save you sand, Mr. Pokey, if that is what you want, but as for saving you any money by doing so, that is out of the question. I am getting twenty-five per cent more work out of my molders than the Eureka is of theirs. While the latter are skirmishing around for gaggers mine are molding and they don't have to shiver every time they close a mold for fear it will fall out on them either. Now, which do you want to save, sand or money?"

"Guess there is something in what you say, Tom. Seems if you gain one thing you lose another. Appears to be a question of selecting that by which you lose the least. I must explain that to Muggins. He can't see a thing but one way. If he should ever lose a button off his pants he would claim it was more economical to tie them on with a string than to buy a new button."

"That is the trouble with too many foundrymen," assented Tom. "They save too many things and too little money. One saves lumber, and his molders waste time in trying to hold his old rotten flasks together. Another saves plumbago and the chippers spend three times the length of time they ought to in cleaning the castings. Some save flour or core compound in making cores by using a close loamy sand and the scrap they make would pay for the flour they save ten times over. Then some foundrymen think they are cute because they can save fifty cents on a ton of iron, never tumbling on to the fact that they may be losing five dollars in machinists' time in finishing the very same weight of castings. Too much saving of things and too little saving of money has driven many a foundry out of business. Some save twenty-five dollars a month in the price of a foreman and lose a hundred by getting a man to suit their price."

"You would have made a fine preacher, Tom, if your morals hadn't been scorched by coming in contact with a foundry. You would do pretty well even now if it weren't for the cuss words you slide in. But say, I just happened to think of something. I believe you told me once that like conditions should produce like results."

"They ought to," answered Tom.

"That is what you told me, but they don't," said Pokey emphatically. "Here is the Phoenix, a shop like our own, same class of work, same style of cupola. We use about the same iron and the identical coke that they do. They melt ten pounds of iron with a pound of coke; we melt eight. I guess you won't find it so easy to crawl out of that, Mr. Bowers."

"It is another case of saving," said Tom, smilingly. "They save coke; do they save money? That is something nobody knows but themselves. Some of the boys tell me they don't have much trouble in keeping a good supply of scrap on the charging scaffold, and it is home-made, too. That is the worst kind of scrap I hate to have around. However, be that as it may, I know that the Hummer company always come here whenever they have any castings that they are in a hurry for. They have got stock in the Phoenix and patronize that concern all they can, and there must be a reason why they pay us more for castings they could get cheaper at the other shop. We get a different result in melting from them, although the conditions are alike, and I feel satisfied that in dollars and cents the result is in our favor."

"Well I must go over and give Muggins a few lessons in saving," said Pokey. "I am beginning to think that he is placing too many of his savings on the wrong side of the ledger. I am afraid he would be ashamed of them if they were to be converted into currency."

"Whenever you hear of anybody who are saving dollars and cents, send them around to me," asked Tom. "I have got much to learn from them. As for the other kind of people who are saving things by the yard or ton, keep them away until their savings are translated into figures that show that they are saving and not losing money. Any damphool can save a few pounds of coke or a carload of sand during the year, but it takes a good manager to save money by doing so. It is one thing to save material and another one to save money."

Economy in Melting.

By J. P. PERO.

Perhaps in no other feature of foundry practice is a man's veracity so often questioned as in the matter of melting ratios; yet I fail to see why we should doubt records in this particular branch of foundry practice.

It has always seemed to me that the men who are the most ready to disbelieve in a ratio of 8, 9, 10 to 1 are the men who pay least attention to the finer details of melting iron.

There are many factors involved in melting iron economically, viz: Construction of cupola, blast, care of cupola, fuel, condition of iron, manner of charging and atmospheric conditions, each of which to the progressive melter represents a component part of a

combination which properly formed means success.

In noting the improvement in cupola construction during the past thirty years, we find the tendency has been to give prominence to the question of tuyere arrangement and size, with a view to the better distribution of blast. In fact, cupola improvement has consisted almost entirely in improved tuyere construction. There is a very important feature which has in a measure been improved, but the importance of which I believe is not fully appreciated. I refer to the height from bed to charging door.

Cupolas vary in height from 8 feet to 15 feet, and under the care of an observing man, all other conditions being equal, the ratios will vary almost in proportion.

By this statement I mean that the man who is not satisfied until he secures the best results with the least possible amount of fuel will find that the higher the charging door the less fuel will be required.

A little attention given to the working of the cupola at the charging door will quickly and thoroughly convince most men that the waste of heat in the shape of unconsumed gases is no inconsiderable amount.

I am aware that many cupolas are so constructed that the combustion is very satisfactory, yet even allowing that the combustion is perfect, there is still a vast amount of heat lost, which might be utilized with a different construction of cupola, viz: A greater height from bed to charging door.

Some years since I advocated the adoption of a plan of construction that would provide for a charging door 12 to 15 feet from the bed, and another about 10 feet above the first.

It would seem that in the modern foundry, equipped with elevators for getting up stock, that the greatest objection to this plan would be easily overcome; that is, the objection to the cost of getting stock to such a height. Perhaps you will think, if such a height is practical or desirable, why was it not adopted years ago? I believe the principal objection in the past has been that of getting up the stock, and it has seemed almost impossible to get foundrymen to increase the height, even with the facilities now possessed for economically handling materials. I recall an instance: The manager of a modern foundry plant, contemplating the erection of a new cupola, came to me for advice in regard to the merits of several kinds of cupolas extensively known. We readily decided upon the particular kind to be used, but in sending figures for the construction of the cupola we disagreed on the height from bed to door. I urged him to adopt the plan here suggested, but while he admitted the plausibility of my argument, his conservatism, together with the fact that we knew of no such plan in actual practice, induced him to decide upon the old plan of a single height of door. Even after reaching this conclusion an argument arose as to the height of the door. He had thoughtlessly planned his charging floor at such a height as to bring the height of the door but eight feet from the bed. I pleaded with him to rearrange his plans to make the height 15 feet, which he could easily have done, but he thought the appearance of the cupola house would be out of all proportion with the rest of the shop, so he finally decided upon 12 feet as the most convenient height. He has since told me that he regretted not adopting the double door plan, and admits that the 15 feet height would have been an improvement over the present plan. I think ultimately this cupola will be equipped with the double door. It would seem that to the practical man this plan would require no stronger argument than a study of blast furnace construction. Is there any result obtained in the working of a blast furnace that would not be desirable in a cupola furnace?

The great height of the blast furnace allows of a greater capacity for charges of fuel and ore; therefore less frequent charging. It also allows, or rather produces, a more gradual heating of the charges, thus preparing the charges for a more speedy fusion when the charge reaches the melting zone, a much desired result, as it is generally conceded that the less the iron is exposed to the direct force of the blast in its transition from the solid to the fluid state, the better the quality of the iron, and the greater height allows of a greater utilization of the heat produced in the melting zone, and which, forced by the blast, passes through the upper charges in escaping from the top of the cupola.

It perhaps may be asked: "Why not have the charging door 20 or 25 feet above the

bed, and have but one charging door?" The idea of two doors is to use the lower one as a matter of convenience, in making the sand bed and in putting in the wood and first charges of fuel and iron.

In this connection I would suggest that instead of putting in the fuel alone before the fire is lighted, that the cupola be fully charged, or as nearly so as possible, before lighting the fire. The very common practice of charging only the bed fuel and waiting until the fuel is well lighted is a decidedly extravagant practice. A great deal of heat is wasted that might under the other plan be utilized, and a great deal of fuel consumed unnecessarily. I have secured better results by charging the cupola in the regular way before lighting the fire.

My plan with the double door system would be to totally ignore the upper door until the cupola had been charged to the height of the lower door, then close and secure the lower door, calk the seams around the door on the inside with the clay used for daubing the cupola, and continue the charging from the upper door. This plan is suggested in connection with the plan of not lighting the fire until all charging is done. In case of poor draft, a gentle forcing by the blower will assure a good fire. The fire should be kindled a sufficient time before the regular blast is put on to allow the bed of fuel to become well ignited. Under these conditions there is less danger of needlessly burning out the bed than under the other plan of charging, as every atom of heat is absorbed in its passage to the top of the cupola. My experience has satisfied me of the superiority of the plan of charging as soon as the smoke of the wood has passed away, and of allowing the cupola to remain charged a reasonable time before putting on the blast. To illustrate: I know a foundry using a 54 inch cupola and melting from 20 to 25 tons daily; their practice is to light the fire at 11 a. m., begin charging at 1 p. m. and put on the blast at 2 p. m. In accordance with my plan the practice would be: Light the fire at 11 a. m., begin charging as soon as fire was well started, that is, wood consumed and bottom of coke well lighted, perhaps from 11:30 to 12 o'clock, and put on blast at 2; for I believe there is a great waste of fuel (because of the heat lost) in the two hours elapsing between the lighting of the fire and the beginning of the charging.

I am aware that in many foundries, particularly jobbing shops, the character of the work is such that the mixtures in the different charges vary greatly on different days, but I believe that the mixtures desired can be known sufficiently early to make this plan thoroughly practical in every shop. The blast is a very important factor in the annual cost of melted iron. Too great a blast means an unnecessary destruction of the lining of the cupola, and a chance of impairing the quality of the iron by chilling, as well as the unnecessary wear of the blowing apparatus. It is the common practice to adopt a rule of a certain pressure in ounces for a given size of cupola; this rule should be used only as a guide or starting point to work from, as conditions vary so greatly that no rule can be adopted as infallible, and more dependence should be placed on judgment, based on experience, than on any inflexible rule.

When I first entered the foundry as an apprentice over twenty-five years ago in the New England States, foundrymen considered first quality Lehigh coal indispensable as fuel for the cupola; to-day very few cupolas are using coal; the majority use coke alone, while some are using in addition to coke a small amount of coal in the bed.

There is no argument necessary to prove the superiority of coke over coal in a properly constructed cupola.

Chipping out and daubing with clay are operations that call for much better judgment than is, in many instances, exercised in the care of the cupola. Some melters will chip the coating of cinder and slag clear to the brick, while others simply knock off the more prominent lumps. The first practice involves an unnecessary waste of brick and destroys the rough surface that materially aids in holding the clay daubing; the other plan necessitates the use of a greater thickness of daubing than is necessary, which is not only a waste of material, but is a very faulty method of daubing, as, if the daubing is too thick, the steam escaping during the drying of the clay causes the daubing to crack, the blast and heat penetrate the cracks, the daubing falls off and the lining is left unprotected.

The happy medium in chipping out is to chip the cinder and slag in such a manner as to leave the lining sufficiently rough to hold securely from ¾" to 1" of daubing, and allow the daubing to completely cover the cupola lining.

A word about the care of the fire-brick stock. I have noticed that when we get a fresh stock of fire-brick (which we have made to order), and use a set soon after their arrival, that the life of that set, under conditions identical with the use of a set used later, was nearly twice as long as the second set. I have attributed this difference to the fact that the brick were stored in a shed used for the storage of molding sand, and concluded that the quality of the brick deteriorated by the absorption of the moisture of the sand. I may have reached a wrong conclusion in this matter, if so will some reader of THE FOUNDRY correct me?

The condition of the iron used is another feature of importance in economical melting, not only the pig, but the scrap, and back stock or foundry waste, gates, runners, etc. I have often wondered if we will not in the near future utilize the sand blast to clean our pig iron before putting it into the cupola. The practice of charging the scrap made in the foundry without any cleaning is, in my opinion, not only extravagant, but is also one of the local causes of dirty iron. Extravagant because of the extra resistance to the penetration of heat offered by the burnt sand on the scrap, thereby using more fuel and calling for extra service on the part of the cupola lining. Demonstrate this fact to your own satisfaction by cleaning well a piece of a gate and melt it in a ladle of melted iron together with a similar gate uncleaned. A good tumbling barrel of a size sufficient to clean the scrap and the cinders taken from the cupola each day is a very good investment; the tumbler should be located conveniently near the cupola.

I have in this article advocated the adoption of the plan of charging the cupola before lighting; I know that many melters have already adopted this plan, but the practice is not so general as it would be if more foundrymen would give it a fair trial.

Many melters make their charges of fuel and iron too heavy. I have seen cupolas when the momentary stoppage of melting was so apparent that the end of each charge and the beginning of the succeeding one were easily noticed.

In heavy charging there is a certain amount of fuel which must be partially consumed before the iron begins to melt, and very often the last part of the charge of iron comes down much duller than the first part of the charge, owing to the fact that the fuel is consumed before all the iron in the charge has become melted. Light charges of fuel and iron will avoid this trouble. If your cupola is properly charged there should be little, if any, difference in the appearance of the iron throughout the heat.

All foundrymen have noticed that under certain atmospheric conditions, noticeably damp, humid weather, the cupola melts much hotter iron; how many take advantage of this condition and cut down the fuel on such days? I have known of a saving of 12½ per cent in fuel on such days, and believe the saving might have been greater without impairing the quality of the iron.

In mixing daubing for the cupola and ladles, an excellent plan is to grind the clay in the tumbling barrel and mixing the sand and clay while dry, by mixing it and putting it through a No. 4 riddle; then wet it and let it soak until next day before final mixing. I am thoroughly aware that the temptation is great to "let well enough alone" in cupola practice; generally the foreman has enough to attend to in other parts of the shop, and with the exception of perhaps telling the melter the amount of the heat and the mixtures he leaves the question of melting entirely in the melter's care. The melter often is satisfied when he produces good iron, and regards any change from the ordinary as perhaps risky; therefore, in many shops, the results obtained in cupola practice are not as good as might be obtained.

Of one thing I feel assured, that is, that if sufficient attention were given to all the details of the proper working of the cupola some of the men who now sneer at the ratios obtained by thoughtful foundrymen would be surprised at the ratios shown by their own cupolas.

Many of the cuss words heard around a foundry at casting time could be avoided if the shop was provided with better ventilation.

European Conditions.

In a recent communication, Mr. Archer Brown, of Rogers, Brown & Co., who is now in Europe, writes as follows:

I have spent several weeks in studying conditions in the iron trade in Great Britain and on the Continent. I thought you might be interested in what I saw in Westphalia, the largest center of iron and steel production in Germany. I visited the great Krupp works and the three next largest producers. Krupp employs 30,000 men, and is running all departments apparently to their capacity. He makes steel by Bessemer process only. The other works mentioned, Gutehofe, Phoenix and Rhenish Steel Works, employ about 5,000 men each and use the Thomas Gilchrist or Basic Bessemer. Each concern makes its own pig iron, and I was amazed to find that the furnaces making the so-called Thomas iron (pho. 0.25, mang. 1.50, silicon .75, sulphur .06) produced an average of over 300 tons per day each. They use a mixture of Swedish, Spanish and home ores. Bilboa costs now nearly $4 per ton owing to high ocean freight; Swedish about the same; coke, $3.75 per ton; common labor 75 cents per day; skilled men about the furnace from $1.50 to $2. The iron must cost them upward of $12 per ton, and yet the works are all crowded with orders, and there is everywhere the greatest prosperity, apparently. The Rhenish Steel Works have just paid a 15 per cent dividend, the Gutehoffnung 12 per cent, and others about the same. I was told that in some cases they were well filled with work for the year 1898.

Two or three facts impressed me very much. One was the extent to which by-products are utilized. The coke ovens are built to supply gas for the converters and coal tar for the market. The furnace slag is ground up to make coarse brick, and the slag from the converters, carrying 10 to 14 per cent phosphorus, is pulverized for fertilizers.

Another feature is the syndicating of the entire business—iron, steel, coal and the minor products. I could not learn of a single interest in these lines running outside of the syndicates. The coal product of the district is 140,000 tons a day and the central office, where it is sold, employs 500 clerks. The several mines maintain no executive organization. If a new works is projected, the men venturing upon it are given to understand that prices will be cut to a point which will ruin them. If American, English or French iron commences to come in at a rate that threatens the industry, prices are immediately lowered to shut it out. At present such imports are not thought to be formidable. Thus everything is absolutely under the syndicate control. In Duisberg, where I stopped, Krupp has commenced the erection of a battery of thirteen blast furnaces, the first three now nearing completion. It is the policy of the Germans to make their own iron, depending upon protective tariff and the syndicate system to control the trade absolutely.

The Roechlings are also building new furnaces in Luxemberg, to make iron similar to the Middleboro No. 3. It is Luxemberg and Longwy (a French brand) that our American iron comes into direct competition with. I visited Maunheim also, the distributing center for Switzerland and Southern Germany for iron arriving via Rhine steamers from Rotterdam.

The reports published this week from Silesia, the other great producing center of Germany, are equally as favorable as those from Westphalia. Some of the large works are reported as having engaged their product through the whole of '98.

Western Foundrymen's Association.

The regular monthly meeting of the Western Foundrymen's Association was held December 15, 1897, at the Great Northern Hotel, Chicago. In the absence of the president, William Ferguson, vice-president, occupied the chair.

The paper of the evening, "A Method for Obtaining Weekly Shop Costs" was read by Mr. W. N. Moore, its author.

METHOD FOR KEEPING WEEKLY SHOP COSTS.

The necessities of shop management with reference to current cost records are: That they be practically accurate, continuously formed as a running record, always up to date within the shortest possible interval, and that the method be direct and inexpensive. The plan here given for recording labor and material costs has been in use for

some years in a stove foundry, and has met these requirements. The various operations of the shops are classified, grouped, and, so far as desired, designated by separate numbers which are known as "shop numbers," and are also used to designate corresponding ledger accounts.

As a matter of convenience, certain numbers are reserved for what are known as standing shop orders, which relate to constant operations; such as Cupola Attendance, Unloading Material, Care of Boiler and Engine, Repairs to Building, Repairs to Flasks and Machinery, Warehouse Labor, etc. Other numbers are reserved for

FIG. 1.

John Smith. ..... No

Week ending 6-20-97

S. O.	M.	T.	W.	T.	F.	S.	Hrs	Rate	Am't.
372	9						9	2.25	2 02
37		8	9		9		26		5 85
63		1					1		22
342						9	9		2 03
Total.	9	9	9		9	9	45		10 12
A. M									
P. M.									

Molding, Mounting, Nickeling, etc. Numbers between 1 and 10 indicate General Labor items. Those between 20 and 30, Machinery and Power; 300 to 400 indicate Mounting Shop Operations; 400 and above are used for special jobs, done either on shop account or custom work. These reservations add a significance to the numbers themselves and facilitate their proper use.

The day worker is furnished with a card such as shown in Fig. 1. On it he records daily the number of hours employed, and makes his own distribution of the time against the single, or several shop orders under which he has been employed during the day. These cards are taken out in the morning and returned at night. He also registers on a Bundy time clock. At the end of the week the time reported is checked by the time clock record. The cards are computed vertically and horizontally, so that a workman's distribution of time must be complete, and is checked by the time paid for.

For piece work, a similar form is used, shown in Fig. 2. The workman is provided with a duplicate card for his convenience, but the real record is made by the time keeper and foreman, using the ordinary means of a gangway count and discount pile. This is cumbersome, but no better way has been found.

At the end of the week, the computations having been made, the cards collectively form a complete pay-roll. But, for the sake of convenience, the items are carried forward and concentrate in a pay-roll book in which are recorded the names of the workmen, with the amounts due; and, under a separate tabulation, the various items shown on the card distribution are brought together under their common shop order numbers. The two sides of the pay-roll—the wages paid and the distribution—being in balance, the pay-roll forms an accurate source from which ledger charges against the shop orders are made. These shop order accounts are carried in the ledger where they can be referred to when desired, and, at the end of the year, enter into an annual cost sheet with which we will not deal in this paper, but only with running records which are made and exposed as often as the pay-roll is made up.

For the purpose of making ready comparisons, the weekly expenditure appearing in the pay-roll under the various shop orders are then grouped under these headings: Superintendence, including watchman, power, etc.; General Labor, including yards, cupola, cleaning, grinding, etc. Warehouse; Molding; Mounting; Nickeling; Repairs and improvements. The castings made are of such uniform character as regards expenditures under the first three of these groups that such differences as exist are ignored. There are occasional exceptions where an

undue proportion of gate, extra hazard from loss or breakage, or other conditions, require recognition to fix individual costs. But for the purpose of this record, these expenditures are charged uniformly against the product by weight, the basis of the charge being 100 lbs. net production of finished castings, deductions being made for all returns to the cupola from whatever cause. The accuracy as to net product is insured by having all returned castings weighed back over the out scales and reported on the daily weight sheet. Liability to error is also decreased by having its weight plainly marked on each truck or barrow, and having the gross and tare both recorded.

A computation on the same basis is also made of the cost of molding; but as this is all done by piece work, and the cost per cwt. naturally varies greatly according to the character of the work in the shop, the figures are only of general interest.

In the other departments—mounting and plating shops—where day-work prevails, the natural costs of the various productions bear so little relation to their weights that comparisons on this basis would be valueless. Therefore, in ascertaining results being obtained in these departments, there is first placed an arbitrary cost price, determined on previous experience, on each stove or piece produced. The weekly outputs of these departments are computed at these assumed costs, and the difference between this computation and the actual pay-roll expenditure is shown as a percentage. This percentage of difference, either above or below the assumed cost of the weekly output, forms a very satisfactory gauge, both for making comparisons and ascertaining exact costs.

Those items in the pay-roll which are grouped under Repairs and Improvements are not made a matter of weekly comparison, as expenditures in these directions are considered as arising more from general policy than from current shop management. They occupy a proper place in the yearly cost sheet.

Of the purchased material which enters into the production of castings, a comparative record of weekly consumption is kept of iron, coke and steam coal only. Iron and coke are weighed as they come up to the charging floor, and the daily weight sheet shows both the gross and tare of each load. Coal is similarly weighed to the boiler room. The materials so delivered are considered as consumed, although the actual daily consumption may only approximately tally. For obtaining an accurate record, this is found to be more reliable than a system by which the weighing is concurrent with the operation of charging, there being at most only a slight temporary inaccuracy in the weekly totals, due to the variations in the amount of surplus stock which may remain on the charging floors at the weeks' ends. The weekly report shows the number of pounds of each of these several materials which have been used to produce 100 lbs. of finished product. It also shows the total number of pounds melted, the returns of broken and discarded castings, and the discount,—each computed on the same basis.

FIG. 2.

Name *John Smith.* Week ending 6-20-07

S. O. No.	Stove.	Board No.	M.	T.	W.	T.	F.	S.	Total.		Price.	Amount.	Net.
86	M. H. 3 B	7	23 / 1	23 / 3	23 / 2	19	24 / 1		112 / 7	105	18	18 90	
84	Job work					1			1		25	25	
	86—18 90												19 15
	84— 25												
	19 15												

The full report is as follows, the figures being entirely fictitious:

WEEK ENDING JAN. 1, 1898.

Net product		125,000	lbs
Iron,	per cwt of product..	94.4	"
Coke,	" " ...	20.3	"
Coal,	" " ...	5.7	"
Total melt,	" " ...	157.	"
Breakage and obsolete,	" "	3.	"
Discount,	" "	4.5	"
Group I.—Molding		$ .97	
" II.—Superintendence, etc.		.124	
" III.—General labor		.325	
" IX.—Warehouse		.156	
" V.—Mounting Dept.	Gain, $32.50	9.7%	
" X.—Plating Dept.	Loss, 17.00	4.6%	

These reports are gotten out by Thursday, covering the operations of the preceding week. The remedial value of information of this character comes not only from knowing it, but from knowing it quickly.

The cost of clerical work involved in keeping this record, over and above that required for the simplest form of pay-roll accounting is not such as to affect its usefulness. The method has a natural fluency, one step following another in simple routine, and but little or no knowledge of the operations of the shop is required to carry correctly the original entries through to the conclusions.

DISCUSSION.

Mr. Ferguson: I would like to inquire how long it took from the commencement of this system before you obtained satisfactory results.

Mr. Moore: It has been in use for six or eight years; and it was begun so long ago that I can hardly answer the question. It proved satisfactory from its inception.

Mr. Ferguson: We are just now beginning with a system, but I am afraid it is going to take too long before we can get at satisfactory results.

Mr. Thompson: While Mr. Moore says the figures given in the paper are entirely fictitious, I would like to ask him if 94.4 per cwt. is anything like the general average of casting produced from 100 pounds of melted iron.

Mr. Moore: I would answer that question by stating that the figures are entirely fictitious. They are not intended to convey anything as to actual results. At the same time if it had been 104.4 it would have made the table more nearly correct. That item is always in excess of 100 pounds. It takes more than 100 pounds to make 100 pounds of casting. Our records show that it takes about 104 pounds of iron to make 100 pounds of casting. Our weekly reports would show something like that. In other words, there is loss of about four pounds.

Mr. Stantial: Four per cent loss in melting?

Mr. Moore: That is it.

Mr. Johnston: I would like to ask Mr. Moore if he has the men extend the amount opposite their time.

Mr. Moore: The men count their hours, the rest is done in the office.

Mr. Stantial: It is impossible for us to adopt any such system as this on account of the variety of our work. It is all very well in a stove or machinery foundry, but where you are turning out all kinds of work you have to keep special costs. I do not see, unless it is getting the general run of castings, how we can possibly apply a scheme like this to our work.

Mr. Ferguson: It has been my experience in the general foundry business, that we have been getting the cost per ton, and once in my experience we tried to get a detailed cost of every individual piece produced in the shop, and after employing this about thirty days—we were running at that time in the neighborhood of 130 molders—we hired a half-dozen clerks to look after the system, and did not consider it a success. I know now of another concern who get individual costs and they handle it in pretty good shape. From my own experience in the general foundry work I never saw the necessity for detail costs. I have always contended that it would cost more money to keep the system running than the gain therefrom. I fail to see any benefit to be gained from detail costs in the general foundry work. In our system we divide the work into four classes. In the first class we put green sand, dry sand and loam work in the second class, hard iron in the third class, and shop tools in the fourth class. The coremakers' time is taken care of in each class. A compilation of that is taken for thirty days, and a report made on that basis always seems to me to be all that can be got out of it. Of course an individual

cost system might be beneficial for estimating closer than this other system.

Mr. Sorge: I cannot agree with Mr. Ferguson as far as the keeping of individual costs is concerned. It is not merely for the purpose of estimating. A keeping of individual costs does give a record as to the expense, and if it is done in a proper and systematic manner it can be done with slight expense. I know where the keeping of costs for 120 molders involved the labor of one clerk, and I could have the individual cost of any piece produced in that shop. As to trying a system of that kind for thirty days I think our chairman will agree with me that that is not a fair trial. Similarly with chemical analyses. He was once connected with an establishment where they tried chemical analyses for a short time and the analyses did not prove a success. Now if you were attempting to make an experiment of thirty days with chemical analyses your results would prove that it did not pay. The same holds good when applied to the cost system. The longer it is kept up the more valuable it becomes. Methods can be judged much more accurately than by the judgment of an individual. I want to ask Mr. Moore a question. He states that he gives a shop number to a certain stove, does that involve every piece of that stove or simply the stove itself?

Mr. Moore: We do not have special shop numbers for the separate parts. There is a multitude of castings and it would hardly warrant the effort to number each one separately.

I will say that this description of our method is not presented as one which is of general application. It was presented merely with the thought that it might possibly be of interest. The conditions in a stove foundry or in any shop making a specialty are of course radically different from those in a general foundry. It is not to be thought for a moment that a plan that will be satisfactory under one set of conditions is applicable to another set. In the three labor items, the groups II., III. and IX., especially group III., a general labor item, which includes the yard work, cupola tending and grinding, we have found a great variation. When we are running a large heat we need a large number of men, but when the heat is reduced two-thirds, then we have to drop off some of the men, and the practical value of knowing that is worth a good deal. The natural tendency in our shop is that when we are running a lot of men and the heats drop down to 40 or 50 per cent. we drop a man here and there, but we keep three-fourths or two-thirds of the men to do one half or one-third of the work, and a report of this kind brings that very forcibly to the knowledge of the office. There are some facts in connection with this method which might be of interest. If work comes in, special work from outside, we attach a shop number to it. The cost of the casting we assume to be practically the same, but the other costs vary greatly. There are special shop order numbers for those items, and we enter them in the ledger accounts, and have them to ascertain the usual costs on a set of castings. We can turn to the ledger at any time and find the actual expenditure on any class of work done.

Mr. Ferguson: I would like to say a few words on the points that Mr. Sorge mentioned. He said that the keeping of the individual costs was not for the purpose of helping to make estimates on work. I have also had it stated to me when I have asked the question how the keeping of shop costs was going to reduce the cost of production, that it was not for that purpose. If it is not for an economical purpose wherein is there any benefit to be gained from the system? I cannot see anything except a knowledge of the whole working of the concern being placed in the hands of the head of the concern instead of in the hands of the foreman or superintendent and left to his management.

Mr. Sorge: I may have stated what the chairman ascribes to me, but I am under the impression that he did not understand me. It is not merely for the purpose of estimating, but certainly it is concerned in the estimating, and does help in the reduction of costs, and is of as great importance in the very thing that our chairman brought out, as anything, that of informing the head of the concern regarding the workings of the shop.

On motion, duly seconded, a vote of thanks was tendered Mr. Moore for his very able paper.

The discussion of the paper on "Molding Sand," by D. H. Truesdale, was continued, said discussion having been begun at the meeting in Cincinnati, where the paper was read.

Mr. Ferguson: I believe it is due to the members present that I make some explanation regarding this chart (Mr. Loudenbeck's table, shown herewith), and in doing that I will state that as long as I have been in the foundry business I did not know anything about molding sand. I never was familiar with the constituents, and when it was given out that this paper was to be further discussed this evening I made up my mind that I would find out what was in our molding sand. I had our chemist make an analysis and this chart is the result of that work:

Molding Sand Dried at 100° C.

	No. 1—Fine sand for snap work.	No. 2—Medium grade for medium class of work.	No. 3—Coarse sand for heavy machine castings.	No. 4—For heavy machinery in dry sand molds.
Silica	81.50	84.86	82.92	79.81
Alumina	9.88	7.03	8.21	10.00
Ferric oxide..	3.14	2.18	2.90	4.44
C'bined water.	3.00	2.20	2.85	2.89
Cal. carbonate	1.85	1.10	1.10	1.25
Magnesia	.65	.98	None	.88
Potassium....	Not es.	Not es.	Not es.	Not es.
Manganese....	Trace	Trace	Trace	Trace
Organic matter	Trace	Trace	Trace	Trace
Total	100.00	98.35	97.98	99.27

Mr. Loudenbeck: Four samples of molding sand were taken for analysis which are designated as Nos. 1, 2, 3 and 4. These samples were dried at 100° C. and the dried samples taken for the determination. This gives a sand perfectly dry and easily crumbled. There is still water in the combined form, which cannot be driven out without additional heat approaching a red heat. This is designated as combined water and is combined with the alumina in the form of clay, alumina (see table) being the highest in No. 4. There is one fact that might be explained in this connection, that alumina is not clay. Clay contains alumina and in its purest form contains about 40% Clay is a hydrated silicate of alumina, that is, it is a compound containing silica, alumina and water. Alumnia in itself is infusible and in nature occurs as corundrum, ruby and sapphire. It forms a slag when combined with silica. Silica in itself is infusible. It occurs in nature as quartz, agate, onyx and sand. All geological formations, except chalk, contain silica or silicates. In molding sand part of the silica exists as quartz sand and part in combination as clay. Although silica in itself is infusible, when in combination with suitable bases it forms a slag. The bases that are suitable are alumina, magnesia, calcium, iron, manganese and the fixed alkalies. These combinations are called silicates and have various fusing points, for example:

Silicate of alumina melts at 2400 deg. c.
Silicate of magnesia melts at 2200 deg. c.
Silicate of lime melts at 2100 deg. c.
Silicate of iron melts at 1800 deg. c.
Silicate of manganese melts at 1800 deg. c.

A more fusible slag is a mixture of the silicate of alumina and lime and if potassium is present, the melting point is lowered still more. If lime and potassium are present in molding sand they will readily combine with silica and form a fusible slag at the contact of the melted iron with the mold. As the melting point of silicate of alumina is 2400 deg. c. I hardly see how a slag could be formed at the temperature of cupola melted iron, and I believe if pure quartz sand and clay are the constituents of molding sand, free from all other impurities, no slag will be formed. It is only when the impurities, such as lime, magnesia and potassium are present that the conditions are favorable for forming a fusible substance and it is only when these compounds are in excess that any great trouble would occur.

Considering the iron, I may say I have estimated this as ferric oxide, but some may be in the form of ferric hydrate and some, possibly, as ferrous hydrate. I have not had time to investigate this as I would like. When these sands were heated to a red heat they became darker in color, changing from a light yellow to a dark red, indicating some

change in the condition of the iron. Iron exists as ferrous oxide in many clays, and if it should be in that condition in molding sand, it might form a slag as silicate of iron, which fuses at a lower temperature than silicate of lime.

I have devoted most of this discussion to the fusible constituents of molding sand and have not considered such important properties, as strength and porosity, and before closing would like to make one statement in regard to the effect of clay on these properties. The confined gases and water vapor must escape, if not readily through the sand then at a point on or near the surface of the casting. The pressure of these gases on the iron while still fluid or in a pasty condition would tend to make a rough casting. A high per cent of clay makes the sand too dense and too strong.

Mr. Sorge: Mr. Loudenbeck does not say whether the calcium carbonate is the normal carbonate or the bi-carbonate.

Mr. Loudenbeck: The calcium carbonate as it exists in nature is usually in the form of the normal carbonate.

Mr. Sorge: My experience has usually been that it has been the bi-carbonate. You will find that if you take the sand after it is washed, the washing contains, frequently, considerable bi-carbonate. The bi-carbonate is very unstable and will give off one portion of carbonate acid, when heated, and is therefore a dangerous constituent in molding sand.

Mr. Loudenbeck: The bi-carbonate as it is found in nature would be washed out and dissolved by the water.

Mr. Sorge: You mean it would not appear in the sand but the water gets it from the sand, it therefore has been in the sand and is constantly being dissolved by water perculating through the sand and consequently is present in the sand. The reason why I ask is because I do not think the mono-carbonate would be as serious a matter in sand as bi-carbonate. The bi-carbonate by giving off one portion of carbonic acid is a serious matter. I have found small pittings in which are inclosed little pieces of white material and at the same time minute holes in the iron. It seemed to me to indicate that the bi-carbonate had given off one portion of carbonic acid.

Mr. Loudenbeck: It seems to me that if the calcium existed as a carbonate the heat of the melted iron would be sufficient to change the calcium carbide to oxide at the portion where the iron strikes the mold.

Mr. Stantial: A number of years ago after a discussion of this kind, I had occasion to make an analysis of sand that was giving the best of results and considered A. No. 1 sand. I had always understood that the presence of lime in molding sand, over say two or three per cent, was injurious, or in other words, was fatal to the sand as a molding sand. In this analysis, quoting from memory, there was in the neighborhood of 11 to 12 per cent of lime in that sand. I cannot say whether it was in the form of carbonate or not. It was a first-class molding sand.

Mr. Loudenbeck: The lime in the sand may be there as a sulphate. If it is in that form I see no particular harm in it.

Mr. Ferguson: I can tell a little of my own experience. I was out in Nebraska in a place where there was no molding sand to be had and I had to use something as I did not have money to import it. I took what is known as alkali clay, which is covered with a white substance. I do not know what that whiteness was composed of, whether it was lime or what it was. We used that clay, a sandy clay, for molding purposes and I never saw better castings made in any kind of material. The castings made in this way came out clean and nice.

Mr. Sloan: I was going to ask what per cent of lime there was in the sand used by Mr. Truesdale. I always supposed that sand containing five per cent of lime would be injurious for molding purposes. I have with me a sample of casting made from sand containing, as near as I am able to learn, from three to five per cent of lime, and I submit it as a proof that lime does not spoil the sand.

Mr. Sorge: The fact of the matter is that the statement that there is lime in this or lime in that does not explain anything. To judge of the effect of the lime on the sand we must know the exact form of its combination.

Mr. Ferguson: We have a sample of a plate here which was presented to Mr. Sorge by Mr. Truesdale, made in sand without facing of any kind.

Mr. Truesdale: I will state that the pattern for this plate was a little white metal card receiver and the sand would not leave the plain surface, which for this reason is a little rough. On the ornamental part the sand left it very clean. The fine lines was what I was trying to produce. It was made with a mixture of very fine sand coming from Zanesville, Ohio, and 60 per cent of pure silica. Both sands were dried and measured.

Mr. Ferguson: I would gather from your statement and judging from the analysis that most of our sand is carrying too much silica.

Mr. Truesdale: I do not think that is good reasoning. That plate would have been better if the sand had been higher in silica. I was afraid to give the man who did the molding an extreme mixture. I was afraid he would play some trick so I made it 60 per cent and stood over him. I would have had far better results if I had had a larger proportion of silica. I wanted to show what could be done in the way of producing fine lines by the use of silica sand. I have had sand brought to me by sand men. They will come in with samples Nos. 1, 2, 3, 4, etc., and will say that they have sand containing about 80 per cent silica and sometimes they say 90 per cent silica. One man said that his sand contained 90 per cent silica and he gave me a sample and I washed it and it only had about 15 per cent silica. I have no chemical knowledge but I am giving my own experience. I have used upwards of one thousand tons of silica sand. The shop I left in Cincinnati used it largely. They used sand containing from 40 to 50 per cent of silica and sometimes it contained 75 per cent and the results were always satisfactory. I have attributed the success of William Resor & Co.'s castings largely, besides the education of the men, to the use of silica sand. I am adopting it here and am having better and better results every day. I have not got to the end of it yet. It is a long hard fight with stupid molders. They condemn a new thing, but I am making progress and securing better castings than they did before. I did not begin with all the men at first. I picked out about a half dozen who seemed to have more sense than the average run. They condemned it at first, now they all want it. The men who opposed it the most are to-day using it gladly.

Mr. Moore: I would like to ask Mr. Truesdale whether in stating that a particular casting was made with sand containing 60 per cent silica, he did not mean that he added 60 per cent pure silica to the sand, so that the actual percentage of silica in the sand must have been 75 per cent or 80 per cent?

Mr. Truesdale: Yes. Mr. Vrooman can tell us how much silica there was in the sand originally. He sold it to us.

Mr. Vrooman: I should say that sand ran about 60 per cent or 70 per cent silica.

Mr. Truesdale: Some years ago we took a contract in Cincinnati for making cornice work and the job came from a machinery foundry where they used coarse sand. The question came up whether we could do it with fine sand. They said we could not do it. I did not believe it and said I was going to try it. I went ahead, and the result was that we made those casting, weighing eight hundred pounds, domes for furnaces, in the fine sand. Now I know these things from practical experience, but I have no scientific knowledge on the subject.

Mr. Vrooman: I looked at that analysis when I came in and I told Mr. Sorge that I did not believe the alumina item was correct. Mr. Loudenbeck says he does not class clay as alumina. I do not believe there is any sand that contains enough lime, oxides or other foreign matter to do any damage. There is sand dug in all parts of this country under all conditions, and there are all classes of work done by all classes of men, and I do not believe I ever saw a shop where the sand ran together in a slag when melted iron was poured into the mold.

Mr. Ferguson: If you will come up to our shop I will show you a case of this kind.

Mr. Vrooman: I do not believe it is due to the sand unless this contains some vegetable matter. Perhaps you used a casting too heavy for the sand.

Mr. Ferguson: It can be prevented with the addition of sea coal to the same sand.

Mr. Vrooman: I think the whole matter in sand lies in its crystal formation. One crystal may be a conductor of heat and an-

other crystal may be a non-conductor of heat. Silica appears in two forms in the sand—free and in combination. The free silica gives porosity to the sand and the silica in combination adds to the life of the sand in connection with the crystal formation. If the crystal is such that it is a non-conductor of heat it does not permit the heat to penetrate as deep as the sand does whose crystal is a conductor of heat. You coat your sand with a plumbago or some other facing that is fireproof and that does not permit the sand to fuse. Coming back to the question of crystal formation, you have noticed when taking a casting from the mold that you can see a white line showing how far the red heat has penetrated causing the sand to lose its life, when it will no longer combine with water. If you have a sand that is not a conductor of heat the heat will penetrate further from the face of the mold and the sand will burn out sooner. It is not the alumina in your sand that makes it wear longer. It is not because it does not have any calcium carbonate or manganese. It is on account of its crystal formation. I do not believe that you will find iron, or lime or any of those foreign elements, except vegetable matter, that will do any damage.

Mr. Truesdale: Did I understand you to say that sand once heated to a red heat is destroyed? I beg to differ with you. I took some sand and put in one of our big boilers and kept it there for ten hours under a heat of 1500° and took it out and the next morning I took it and molded in it.

Mr. Vrooman: I will take the same argument as with fire-brick. Fire-clay is about as plastic as anything you can get hold of. If you mold it and put it into the form of a brick and bake it in an oven and take it out and allow it to cool and regrind it, it never will combine with water again. It may be possible that your heat was not sufficient.

Mr. Sloan: Mr. Vrooman has made a statement that fire-brick is about as plastic as anything you can find. All fire-clay is not plastic. Fire-clay comes from some parts of Ohio, Pennsylvania and is as hard as a rock. Plastic clay makes the poorest brick upon the market. I would like to ask Mr. Truesdale how much facing he used on that plate.

Mr. Truesdale: That has not a grain of facing of any kind used upon it. I used a No. 24 riddle.

Mr. Evans: I would like to ask whether there would be any economy in using a No. 10 riddle rather than a facing.

Mr. Frohman: There has always existed the impression that facings are black, but we manufacture a facing that is called a silica facing and is made from pure silica and ground very finely and bolted. It is practically the same as the sand that Mr. Truesdale is using. It is a question whether it would be cheaper to buy this facing or to use silica sand and use a very fine riddle.

Mr. Evans: If this silica sand is such a fine thing I should think all the foundries in the country would adopt it. It seems to lie with two foundries, one in Ohio and one in Illinois.

Mr. Truesdale: I have had something to do with trying to introduce new ideas to molders. The average molder is not very good at taking up with these. A foundryman will come into your place and see you doing a new thing. He will say that is pretty good, but he will not adopt it.

Mr. Moore: I want to say a word or two regarding the reason why if it is a good thing it has not been adopted by a whole lot of foundries. The fact is that there has been a class of work done in the William Resor Company's foundry which is superior to that done by any other foundry, certainly this side of the Hudson river, and possibly it might be in this country. The reason why the rest of us have not done the same thing is because we have not taken the intense interest they have.

Philadelphia Foundrymen's Association.

At the last meeting of this association, held in Philadelphia, December 1st, the executive committee reported as follows:

"This meeting finds us in the last month of the year, when we had expected every foundry in the land would have all it could do running six days per week. As a matter of fact, we find there is a great improvement over this time last year, and while there is room for further improvement, the output of the foundries in general is very much better than it has been at any time during this year. This, of course, is more satisfactory; but the trouble is still that prices are exceedingly low, and we do not see that

this condition of affairs can be bettered until the foundries are filled up with work, when they can afford to ask better prices for new contracts. In other words, supply and demand have much to do with business in general. It looks as though the supply was greater than the demand, but this great and prosperous country is growing very fast, and it seems that the near future will bring with it a better demand and at better prices. We know of a large number of foundries that have about all they can do, some of them having enough work to run their shops full for six months, while others are doing a hand-to-mouth business that is not at all satisfactory. But as a rule we can see a great improvement over the past year. To-night we have no set paper, and the attention of the meeting is called to discussion on topics of interest to foundrymen leading up to economical productions. We think the thought expressed by our president at the last meeting, inviting the proprietors of the different foundries to bring with them their superintendents and foremen to the meetings, is a good one and will enable those acting on it to pick up information of value to the plants which they represent."

A general discussion followed in which trade conditions were reported as being more encouraging than for some time, although the prices obtained for castings were showing no tendency to advance.

The Pewabic Founders.

(By Telegraph.)

Following the example of their brothers in other parts of the country, the foundrymen of Pewabic and vicinity have at last realized the necessity for a closer amalgamation. Their first meeting was held last Friday at the Grand Central Hotel, Pewabic, at which a permanent organization was effected.

Pumice De Witt, of the De Witt Sausage Machine Co., Pewabic, was unanimously elected as president, while Asbestos B. Hellso, senior member of the firm of Hellso & Holdon, Paradise Flat, was chosen as secretary. The selection of a treasurer was deferred to such a time as money should appear in the treasury, with no other alternative of getting rid of some.

President Pumice DeWitt appointed Tubal C. Klaiwash, Pasty Groesbeck and Flux McFadden as members of the executive committee, with instructions to retire to the anteroom and prepare a report upon the current condition of the foundry business. The president suggested that the committee provide itself with an empty core compound barrel in which to deposit stray ideas for future improvement of the trade, conceived while in session.

When the committee had retired the president delivered the following address:

Members of the Pewabic Foundries.—We have come together for the unselfish purpose of finding out what our neighbors know. It should be the ambition of each member to secure all the information he can without giving anything in return. Then it should be our aim to keep aloof from any society similar to our own, because the foundrymen of Pewabic and vicinity occupy a sufficiently exalted position to dictate as to those with whom they should keep company. If we become too familiar with others they will discover the abundance of kinks by which we are enabled to secure contracts from one end of the country to the other. The object of our organization should be to ask questions of foundrymen outside of our membership. In the past it has cost a considerable number of drinks to find out anything of importance, and the present arrangement should result in a perceptible saving to our members. In consideration of the fact that our members invariably patronize the wet goods to be found on the premises, we have been granted the use of this room free of charge, with the privilege of sending the cook after a surgeon should an occasion arise. If you have anything which is worth knowing, be sure to keep quiet about it. On the other hand, if you are chuck full of information which nobody cares to carry around as ballast, prepare it into a paper to help out the trade journals who are depending on you to fill their pages. Give them to understand that they can depend on us to supply those which are too poor to pay for original matter with the missing link of their business. By doing this you will earn their lasting gratitude and free reading notices in case you should have aspirations for any office in this organization.

After the waves of applause had subsided, Hink Hokum, of Squan Creek, moved that the association consider the following typical questions:

Can poor flasks be used to advantage in shops where soldiers are clay-washed the full length?

John Gaggerless, of the Bungtown Agricultural & Bedspring Co., said the question was somewhat indefinite. If the speaker referred to clay-washing the shops the full length he thought that poorer flasks might be employed, as the clay-wash would infuse an extra amount of humidity into the atmosphere, and as the air would consequently have a greater specific gravity underneath the mold than in the upper portion, there would be less liability of the sand falling out owing to gravitation, as the thick air underneath the mold would have the tendency of acting as a prop.

Transverse Nockatuck stated that from experiments he had recently conducted and tabulated the tensile strength of a clay-washed soldier was increased six ounces to the square yard by being swatted on the end with a dull ax.

D. Oxite Bosphorus, chemist of the Bulldozer Co., disputed this assertion. From eleven hundred determinations which he had made to discover the cause of soldiers refusing to remain in contact with short bars, he had arrived at the conclusion that a rearrangement of the fibres in the pine takes place, while the sand is being condensed through the medium of a butt rammer. From analyses which he had made it was evident that the decomposed feldspar in the clay-wash assumed a horizontal position, and this accounted for the failure of Mr. Nockatuck to trace the phenomenon to its proper source.

Wayback Gulliver, of the Piper's Gulch Manufacturing Co., insisted that both of the speakers were wrong in their conclusions. He had never been able to see why some foundries would stint lumber in making flasks, and then split up ten times the amount needed to make decent bars into soldiers. He argued that what most foundries needed to make money was not a chemist, but a carpenter. Instead of pinning their faith to a chemical analysis, he thought the same amount of money could be better used in obtaining a keg of nails. Some people, the speaker said, are more interested in finding new trouble than in curing what they have already got on their hands. If they need a physical test let them go out in the yard and break some pig iron. They will find out a whole lot more in that way than they will figuring things down to the thousandth part of an inch in their office with a lead pencil. They make the mistake of their lives by supposing that nothing can be learned unless they wear a boiled shirt and a plug hat.

The speaker was called to order by the president of the association, who announced that it was against the object of the society to say anything at the meeting which would hurt the feelings of a fellow member.

Prudence Skinflint thought that considerable economy might be effected in the operation of foundries if the fine particles created in producing soldiers were utilized as toothpicks.

Sublime Cannon agreed that great opportunities were possible in this line. He had made it a rule in his shop that apprentices should spend the first six months in learning how to accurately measure a soldier. He had observed that in the majority of shops the molders made a practice of having their soldiers show above the bars. This could be directly traced to the inferior training the molder had received in his youth; whereas, if some uniform system of apprenticeship was adopted we would in a few years have a supply of skilled mechanics who would be able to daub a soldier without painting their pants.

The executive committee having returned, Chairman Flux McFadden reported as follows:

The current volume of business shows a marked improvement over a year ago, though prices remain unchanged. Deacon Whitewings let a contract last week for two stove legs, and cold weather has thrown considerable grates into our foundries. It is pleasing to note that home concerns have secured the bulk of the trade, and our export business is fast increasing. By comparing the revenues of the Pewabic postoffice we find that there were six more stamps sold last week than in the same time a year ago, though this is partially offset by a loss of four postal cards. Times seem to be brightening, and we are sure we are able

to distinguish the milk wagon on dark nights. With the national government in thorough accord with the principles of the citizens of Pewabic there can be no doubt but that the future has great things in store for us.

Scrappy Pinocle said that his firm, the Pinocle Foundry and Machine Co., were running full handed for the first time since Cleveland was elected sheriff of Erie county. Their principal output, he stated, was iron work for snow shoes, a large number of which will be needed in the Klondyke country next spring in order to provide transportation facilities for those who will want to return.

The following resolution was offered by Henry Bessemer Molecule:

Whereas, The United States are coining silver dollars; and

Whereas, This has a tendency to increase the price of silver lead;

Be it resolved, That the Pewabic Founders earnestly protest against the government being a participant in any action tending to injure the chances of the foundrymen of the country from having their castings peel, without undue exercise upon their part.

It was announced that a paper on a subject of interest to the trade would be presented at the next meeting, and that members would consequently be searched in the anteroom before entering the hall in order to secure a peaceful discussion.

After adjournment the members repaired to the roof garden of the Grand Central Hotel, where a light collation of wiener wurst and sauer kraut was served.

The Melting Ratio.

By W. F. PRINCE.

The question is asked, what progress have we made in our melting and cupola practice, and is there chance for improvement, and if so, how? It appears to me that the time has come when the foundry business is being considered by those that have in the past given it but very little attention or help, "the owners." In my opinion we have progressed very slowly, and all the improvements we have have been forced upon instead of being sought after by the foundry owners.

According to history, we are taught that the first foundry in North America was built by an Englishman by the name of Dexter, in that part of Lynn, Mass., now called Cliftondale in the year 1640. The ore used was a rarity of limonite, known as bog-iron ore, which was taken from Hawkins' meadow, now a part of the Lynn water works system. Charcoal was used for fuel, and shells for flux. The writer has examined the old dump of this plant and found pieces of slag and iron together. The iron is white and very hard. Their chief product was iron kettles. A sample of their work is now to be seen in the city hall of Lynn. For a cupola they used a shell as we do, lined with brick and clay of their own make. Their charcoal came from the woods of Cliftondale, and their shells from the Lynn beach. Their sand must have been from the banks in the vicinity of their plant. The castings they made were of a difficult nature, both to mold and cast. From such a grade of iron as they had to work with they must have melted their iron very hot. I think we would find it difficult at the present time to make our pots and kettles from the same iron. In my opinion they melted as well in those days as now.

What improvements have we made? We use the same shape cupola; wind is used the same now as then; the furnace is charged just the same; iron and fuel put in and metal taken out just the same. In my opinion a melter of the first foundry could walk into our foundry and take off a heat without any trouble. True, we have coke for fuel, which is cheaper than charcoal, but the foundry deserves no credit for using it. It was forced on us, and we can all remember how hard it was to introduce it. It could not be used, was the cry, and a thousand and one objections were raised against its use at first. We have to thank a few energetic and persevering foundrymen for its introduction. One by one the foundries came into line. We have modern blowers and fans, driven by modern engines, which help to cheapen and increase the production, yet we still cling to the old stack, same wind, same tuyeres, same style of charging, same flux, and, in fact, are we not very close to where we started from? It may be that our present method is the only way

it can be done. If so, how fortunate for the old pioneers, that they happened to strike the only idea, and one that the great mechanics of to-day cannot improve. My idea is that it can be improved upon. As I stated, the foundry owners have taken but little interest in the foundry except to find fault with the results. They have not been foundrymen themselves. They build a foundry and hire the most practical man they can to run it. This man is full of ideas and goes to the owner and shows him his ideas. Some are accepted, but the greater part are not as they are too deep for the owner to understand, they are therefore not considered. How many companies are there to-day that would put their foundry in shape, according to their foreman's ideas? If a foreman should go to you and show you his idea of a new design for a cupola, or some device to attach to your old one that would cause you to shut down a few days and would cost to try, say $200, how many are there that would consider it for a moment? Yet in your machine shop, if you have an idea of a new tool, or you are building a machine, you think nothing of spending twice that amount to try it. I can recall a case where I worked some time ago, they were melting in a McKenzie cupola, using coal for fuel. Their heats were large, and the melting slow. The idea came to me that a center tuyere could be used to allow the wind to reach the center and increase their melting. I showed it to the proper parties, and they thought the idea very good, yet they would not advance one cent to try it, and went on year after year taking all the afternoon to melt twelve to fifteen tons, forty to fifty molders laying around waiting for iron each day. This company are to-day melting in the same old cupola, I believe half coal half coke, at about one to five. They are a very wealthy company, and have plenty of money to experiment with. I have known strange inventors to come there, show them ideas of improvements, to apply to their machines. They would take him in, fit up a place for him, pay him a salary, make his drawings, patterns and castings, machine them and in fact spend thousands of dollars to try something only to find it of little use. Yet in most cases their experiments proved successful and was the keynote to their success. They were willing to try what they could see through, but proposed changes in the foundry they could not see through and would not invest their money in. Is this not the case with the greater part of our foundries to-day? What part of mechanical industry is there that is so crude from beginning to end as the foundry? And it is not because the foundrymen do not know better it is because they are not helped by those that can help them. I should like to name some parts that to me seem wrong. Why should we start a good molder to work in the morning, in a hot sand heap, dry as dust, all tumbled up, and sand mixed with scrap, and wood from last night's cast? The sand cannot be put in good condition, the hot sand ruins our patterns. We pay a man from twenty-five to thirty cents an hour to do this work. He is all tired out before his day's work starts. Why should he not come to work in the morning, find his floor clean, his sand in good condition, and mold on his floor till six o'clock at night, instead of stopping at from three to five waiting for his iron? He does not know when he will get it, but must be ready. If he has finished casting at three, you cannot expect him to stay; he is wet through with perspiration from his labor. Make him a mechanic, not a laborer. Why should the foundry be cold in winter? Why should it be dark at night? Why should we not have a tool or stock room, where all bolts, jogging, wedges and clamps could be kept? Why should it not be cleaned up as well as a machine shop? Why should you not give the molders all the improvements you give a machinist? A great many will make the excuse because molders will not do any better, or produce any more than under the present conditions. It is not so. Molders will work and produce according to surrounding conditions. There are foundries that have taken up this work and the results have been highly satisfactory. In fact the good results shown in these foundries have started the manufacturers to looking into their foundry departments. If the foundryman is given a chance, he can put the foundry on the same footing with other lines of industry. Yet it is so far behind now that it requires extra cost at the

first, but it will all come back in a short time.

But how to improve our melting? All foundrymen are full of ideas. The business itself is largely dependent upon sound judgment. It cannot be learned from books. Every foreman or molder has his own ideas, and every idea of improving our melting should start from them. The American Foundrymen's Association is doing good work. Let it offer two prizes, one to the party that will advance the best idea of a new design of a cupola; second, for the one that will forward the best practical appliance to be attached to our old style of cupolas, with the object of improving our melting. The merits of the proposed improvements to be judged by a committee appointed by the Association. The improvement or cupola selected to be the property of the Association upon the paying to the inventor a royalty on all such cupolas or attachments used. I think it would bring out some startling ideas that have been held by the foundrymen , and amongst them all some actual improvement might be found. The idea often comes to me why do we carry all our stock way up in the air? Why not have our cupolas on a level with the shop? Why not lift our iron out of a pit, or use some of the waste heat going out of our stack by conveying some of it to another cupola and use it to some advantage. How many companies will pull out their whole boiler plant to put in something to save fuel, and see what goes out of our stacks four hours out of the ten. This and thousands of other ideas would be brought to light. If all foundrymen would contribute to such a prize, I feel it would be beneficial to us all and prove my statements that the foundryman is not to blame that the foundry has not progressed as fast as it should, but that their knowledge has not been wanted by those whom it would most benefit.

Among the Foundries.

A. Knothe intends to erect a foundry at Fairmont, Minn.

F. B. Torrey has opened a brass foundry at Bridgeport, Vt.

A. H. McRae's foundry at Mansfield, Mass., was burned Dec. 10.

The foundry of I. B. Coleman, Elmira, N. Y., was burned recently.

S. A. Clark will establish a foundry at Grand Junction, Colorado.

Philip Tinlin has purchased the foundry of B. H. Wells at Ithaca, Mich.

Lockhart & Anthony, of Bellefontaine, O., are building a new foundry.

P. Reisick's foundry at Allegheny, Pa., was visited by fire recently.

The Brown Mfg. Co., of East Manchester, N. H., is erecting a new foundry.

J. H. Mitchell is erecting a foundry at 821 North 13th street, Philadelphia.

John Connors has purchased the Blake Bell foundry at South Boston, Mass.

Anderson Reading has leased the foundry of H. M. Sovereign at Pottersville, N. J.

Redpath & Lewis have recently completed a foundry at South McAlester, Ind. Ter.

Charleroi, Pa., is reported as seeking the establishment of a foundry at that place.

James H. Vahey has been chosen president of the Plymouth (Mass.) Foundry Co.

The Glamorgan Pipe and Foundry Co., of Lynchburg, Va., are erecting a new foundry.

The foundry of the Gerst Bros.' Mfg. Co., at St. Louis, Mo., was damaged by fire recently.

Foster & Krueger will establish a new foundry and machine shop at Menominee, Wis.

H. G. Johnson & Co., of Corsicana, Tex., are preparing plans for an extension of their plant.

The Griffin Wheel Works, of Tacoma, Wash., have begun the work of increasing their plant.

The Davis & Farnum foundry, at Waltham, Mass., was totally destroyed by fire December 2.

The foundry of McPherson & Co., at Fingal, Ont., has sustained considerable damage from fire.

Mr. A. S. Bell, of Tioga Center, N. Y., has purchased the Elkland (Pa.) foundry and machine shop, and the establishment will be materially enlarged and improved.

The partnership of Pickering & Smith, of the Lawrence (Mass.) Iron Foundry has been dissolved.

The Atlantic Iron Works, of Atlantic, Ia., have been organized to engage in the general foundry business.

Goodell & Waters' foundry, at Philadelphia, was gutted by fire. Damage reported covered by insurance.

The Brunswick Construction Co., of Brunswick, Me., are contemplating the addition of a foundry to their plant.

Mr. E. A. Garey has become a member of the firm of Lee & Shumway, foundrymen and machinists at Wyalusing, Pa.

The Alabama Foundry and Machine Works, at New Decatur, Ala., will double its capital stock and enlarge its plant.

Bridgeford & Co., of Louisville, Ky., are reported by the local press as intending to construct a large foundry in the near future.

Mr. Ramsay has disposed of his interest in the Tarrant & Ramsay Co., of Chicago, and the name of the corporation has been changed to the Tarrant Foundry Co.

By the breaking of a crane in the foundry department of the Barnum & Richardson Mfg. Co., Chicago, Albert Hellander, an employe, was crushed to death.

William Fitz Simmons (late of Clinton, Ill.), will establish in Cordele, Ga., an iron foundry and machine shop, erecting new buildings and putting in new machinery.

E. H. Walker, superintendent of the foundry of Emerson, Talcott & Co., Rockford, Ill., has accepted a similar position with the J. I. Case Co., of Racine, Wis.

The Madison (Ill.) Car Co. has been absorbed by the Missouri Car and Foundry Co., of St. Louis, and will be operated as a part of that concern.

Charles N. Sherman has purchased an interest in the Brownville (N. Y.) Iron Works, and will be associated with D. B. Gotham in the management of that concern.

The Parlin & Orendorff Company, of Canton, Ill., has leased the foundry of J. M. Savill & Son on account of the limited capacity of their own foundry.

The plant formerly operated by Maltby & Wallace, at Champaign, Ill., will hereafter be used by the Champaign Machine and Supply Co.

James Barker, of Philadelphia, Pa., is enlarging his foundry by an addition 95x85, to be used as a molding room. A new core oven is also being constructed.

The partnership existing between Hugh F. Davitt and John F. Shea, founders at Springfield, Mass., has been dissolved and the business hereafter will be continued by Mr. Davitt.

The Card Electric Co., of Mansfield, O., are erecting a new foundry 50x100, traversed by two cranes. An extension to the shop, 15x100, provides space for cupola, cleaning room, etc.

Ike Adler and associates have organized the Southern Iron and Steel Co., at Birmingham, Ala., with a capital stock of $25,000, and will erect at once a plant for general foundry work.

Peter S. Braucher, who was recently appointed assistant foreman of the brass and iron foundry of the P. & R. shops, at Reading, Pa., will have entire charge of the brass foundry hereafter.

William Sleicher, president of the West Side Foundry, Troy, N. Y., has leased the old Ruggles foundry at Poultney, Vt. Between thirty and forty men are already at work, and more will be employed.

The Saco Water Power Machine shop of Biddeford, Me., recently became consolidated with the Pettee Machine Works, of Newton Upper Falls, Mass., under the name of the Saco and Pettee Machine Shops.

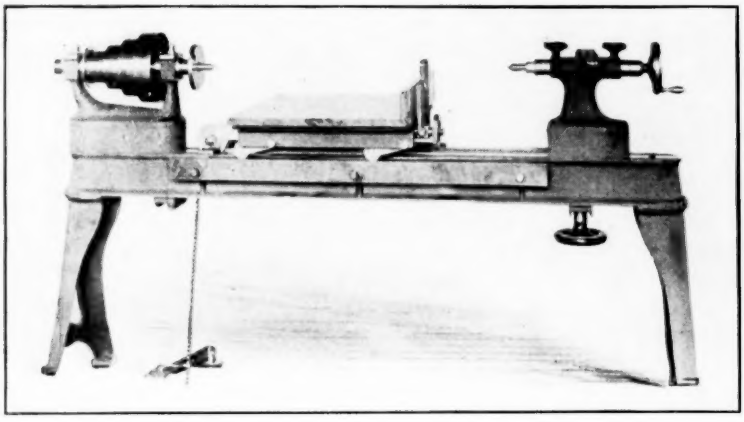
Fred. Cowden, who for a number of years was foreman at the American Steel Casting Company's shops at Chester, Pa., has decided to go into business for himself, and has rented the foundry at Marcus Hook, Pa., and will be ready to start it up in a few weeks.

The Jackson & Woodin Manufacturing Co., of Berwick, Pa., are extending their foundry building by an addition which covers practically one-half the ground of the original foundry. The construction of the new portion will be similar to that of the present building, having steel trusses supporting the roof and carrying the trollies for transporting material over the foundry floor. They have given the contract for furnishing and erecting the steel work to the Berlin Iron Bridge Company, of East Berlin, Conn.

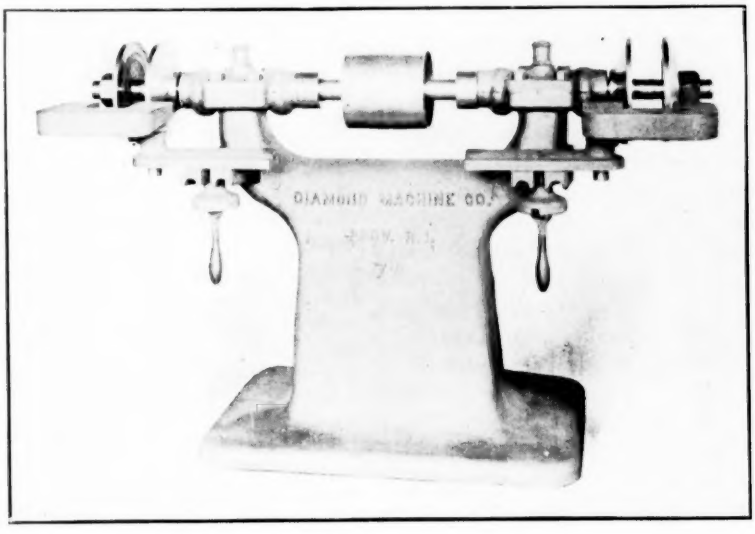
Last week the Watts Steel & Iron Syndicate, Middlesborough, Ky., put one blast furnace into operation, after an idleness of more than a year. The mixture is low phosphorus, Ducktown ore and Cambria, with Stonega coke for fuel. The pig iron is guaranteed under .40 phos., and it is claimed has peculiar merits. The former agents of the Watts Syndicate, Rogers, Brown & Co., have been reappointed for the central and western districts. No definite plans have yet been matured in regard to starting the large steel plant connected with the Watts furnaces.

A Couple of New Tools.

Special machinery for different classes of foundry work is being recognized as an important factor in economical production. By neatly trimming a casting its value is increased more than is commonly supposed. The most perfect casting appears unnecessarily crude if the fins and gates have not been removed in a workmanlike manner.



STOVE MOUNTER'S LATHE.



A NEW GRINDER.

We illustrate herewith a stove mounter's lathe, designed especially to supply the needs of stove manufacturers. It is supplied with various devices adapted to the stove

mounter's work and will prove superior to any of the common tools now in use by that part of the trade.

Our second illustration is a new grinding machine, built with a view of supplying the wants on the part of the average foundry. It was put on the market a short time ago to meet the demand for a good, heavy, reliable machine that would not be very expensive. It has long babbit boxes with three ring oilers in each. Arms and rests are provided as with the more expensive machines. Both of these machines are manufactured by The Diamond Machine Co., Providence, R. I.

He Agrees With Mr. Prince.

Editor THE FOUNDRY:

In the Christmas number of your journal appeared an article on false melting ratios, by Mr. W. F. Prince, that interested me very much. I have been in the foundry business about 19 years, acting in the capacity of foreman of the molding room the greater part of the time, and in my experience I have had charge of shops where the ratios differed according to the kind of work turned out, and the size of the molding room, and the facilities for handling the iron when melted. At present I have charge of a light gray iron and medium weight machinery jobbing shop. We make all kinds of work, ranging in weight from an ounce to a ton. The molding room is about 350 feet long by 120 feet wide. Our crane is situated directly in front of the cupolas, which are located in one corner of the shop. This necessitates our making the heaviest work near the cupolas, and of course forces our light work farther away. The greater part, in fact, nearly all of our work, requires very hot iron, and it is my constant aim to furnish it hot enough so that it can be carried in a hand ladle to the extreme end of the shop and used in the very lightest work we make. I place no restriction on the melter as to the amount of fuel he uses, but instruct him to keep it hot. I compliment him when he gives us an extra good heat, and he takes a natural pride in making each heat as good, if not better than, the last. But although I place him under no restriction, every pound of fuel and every pound of iron is accurately weighed, and so we know just what we are doing each day. It is impressed very forcibly on his mind that any man can melt iron who can throw it into a cupola, but the successful melter is the man who can get the best iron with the least amount of fuel. Our iron, as a rule, is boiling hot when taken from the cupola during the entire heat, and I have seen a number of ladles taken after the blast was shut off, all of which were at a boiling hot heat. We use Lehigh coal for a bed and coke between charges, from which I get a better result than by using all coke or all coal, as my experience with all coke melted iron is that it loses its fluidity or life much quicker than when it is melted with good coal, and that is a factor we wish to retain where the iron has to be carried great distances and poured in very light work. In this shop I get a ratio of one to nine, and let me say right here with Mr. Prince, that I, too, consider one to nine good melting.

In another shop where I was once employed, we reached a ratio of one to ten and one-half quite as easily as I here reach one to nine, but the conditions were much different. The shop was smaller and the work was heavy and not at all particular, and could be gated to receive dull, sluggish iron. But one heat out of our cupola here, such as we got in that shop every day, would be called a bull heat, and if we were to give the boys two in succession I am afraid they would call for their time and want to get out.

No, I never got as high as one to fourteen, although I bunged up a cupola on several occasions trying to when I was younger and knew more than I do now. But when a melter (one who knew his business, by the way) put on his coat and hat one morning and walked up to me and said that if I was going to run the cupola I would have to peck it out, I gave it up as a bad job, and contented myself with reading how others did it.

There are other places around the foundry where we can save more money for our employers than by cutting down on fuel. I think that if we had more foremen like Mr. Prince a true ratio would soon be reached, and many of the high ones would drop into oblivion.

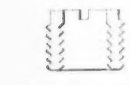
J. C. L.

German Foundry Wrinkles.

By ROBERT GRIMSHAW.

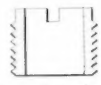
As a rule, I do not find the Germans as full of wrinkles, metaphorically, as a rhinoceros is actually. I found, however, in one foundry three distinct innovations over usual German practice.

The first was in the same line as our lifting-plate, which latter seems absolutely unknown in Deutschland. The idea was simple and in part neatly carried out. A thimble-like brass piece (Fig. 1) about a centimeter (0.4 inches) long, and threaded internally and externally, is screwed into the



Lifting Socket

Fig. 1



Dowel Socket

Fig. 2

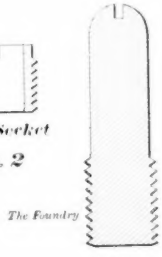


Fig. 3

top of the pattern and is lifted out by a thread rod; but this last, instead of terminating in a ring, as with us, had a contrivance for a separate wooden handle, which is not so good. The thimble, or nipple, is very neatly made by pressing internal and external threads at one operation, and is provided with a slot, or rather with two slots, at opposite ends, by which to run it in with a screw-driver.

Fig. 4

The second device is a dowel and socket arrangement (Figs. 2 and 3) for flasks; also of brass. The socket has only external threading and has cylindrical bore and slots for a screw-driver. The dowel very strongly resembles a gas-burner tip, except that at the base the thread is external. The slot at the top is, of course, for a screw-driver.

The latter is very much more practical than I had expected from a German, being arranged to fit four different diameters of dowel sockets and of lifting sockets (Fig. 4), but instead of having a handle-like enlargement at the upper end, it has a tongue, and a badly-shaped one at that.

(We have published this as an example of foreign practice, although we believe that there are several improved dowel pins made in this country, which for simplicity and directness of application surpass the method just described.—Ed.)

Obituary.

Hemy L. Hermance, of Hermance & Co., Kingston, N. Y., died Dec. 7.

Charles P. Ryther, senior member of Ryther & Pringle, Carthage, N. Y., expired November 22.

John M. Groff, of Groff & Co., Elizabethport, N. Y., expired at his home in Brooklyn, N. Y., December 4.

Jonas Snyder, treasurer of the Thomas, Roberts, Stevenson Co., Philadelphia, died in that city November 23.

Thomas A. Reiley, president of the New Brunswick Foundry Co., New Brunswick, N. J., died December 6.

James H. Coddeny, at one time foreman of the Taunton Iron Works, Taunton, Mass., died at that place recently.

Solomon S. Detwiler, president of the Keeley Stove Co., Columbia, Pa., died on December 5th in New York City.

Cornelius C. Lent, president of the Peekskill Stove Works, Peekskill, N. Y., who died in that place recently, was an old foundryman, who entered the trade as a molder's apprentice more than half a century ago.

Archibald Hamilton Maxwell, a member of Pennsylvania's "Old Guard" of foundrymen, died at Altoona, Pa., Dec. 8, aged 79 years. Mr. Maxwell was of Scotch ancestry and was born in Haslingdon, Lancashire, England, on Nov. 6, 1819, and came to America with his parents when he was but 3 years old. As a boy he began work with Bullock, Davis & Co., who conducted an iron foundry at Kensington, Philadelphia, and continued with them until 1843, when he went to Mobile, Ala., to conduct an iron foundry for Auld & Spear. He returned north in 1846 and located at Lancaster, Pa., with Gorra & Whitehill, continuing at his trade. He was afterwards with Holman & Simon, at Harrisburg. It is a fact worthy of note that he molded the iron work for the first bridge

across the Susquehanna at Rockville; also the columns needed to erect one-fourth of No. 1 roundhouse, used for the Middle division engines, in Altoona. In 1850 Mr. Maxwell entered the service of the Pennsylvania Railroad Company at Harrisburg, doing principally brass work. In 1852, the year the company established its shops at Altoona, he went to that city and took charge of the brass foundry. In 1863 he was placed in control of both the brass and iron foundries and had as many as 400 men under him at times. About the year 1890 he gave up the position of foreman because of ill-health and advancing years and was succeeded by H. H. Stone. Since then he had lived a quiet, retired life.

Casting Gears in Baked Molds.*

I think a word ought to be said in favor of cast gears, if they are made in the proper manner. As cast gears are generally made when hot metal is poured in, the result is anything or nothing—cracked gear or anything else. The strength of such gears cannot be determined except accidentally. But there is a way of making cast gears so that they will be nearly as good as the best cut gears, and it is a very simple way. Take a cut pattern and mold it up in a material that will bake pretty hard; then leave the gear right in the mold, and put the whole flask and pattern in the core oven and bake it. The result will be that, as clay or sand expands less than metal, the expanding metal pattern will crowd the sand so that upon cooling, the pattern will lie loose in the mold, and it can be taken right out. The cope is then put on, and before the flask is cold the metal is poured into the mold, which is free from dirt or dust. The dust can be blown out with a blower if it is necessary, but there really is not sufficient dust in the mold to hurt the casting. The metal is put into the hot mold, and the result will be gear which is sufficiently good to run in a printing press without any noise. These gears are used on printing presses, and people who use them do not know that they are not cut gears, because if the cut gear used as a pattern has the slightest tool mark on it those tool marks will appear in the casting. Such gears are used at the present time. I think the patent on this method expired long ago. Such gears are strong. As the mold is hot when the metal is poured in, the shrinking or cooling strains are less, and the metal is not chilled so rapidly when it reaches the mold. It is, of course, chilled, but not so fast; and, besides, the hot flask, with all the material in it, helps to anneal the iron during the cooling process, so that an almost uniform condition of metal is obtained in the gear. In ordinary cast gears there may be anything but a true gear. There are shrinking and cooling strains, possibly a bad core, slight cracks in the corners, even though they are not true shrinkage cracks; there are surface shrinkage cracks which are, I think, generally disregarded, but they are of importance in considering the strength of a gear. Some loose material will perhaps get into the surface of the gear and as soon as the metal begins to wear down it will wear badly. There are other reasons why an ordinary cast gear is never as strong as the formula indicates; and all formulae, except when applied to cut gear or annealed gear, should be empirical rather than rational, for the reason that the factor of uncertainty cannot be readily applied to a mathematical —a rational—formula any easier than determining a few strengths of different gear empirically, and then using a formula constructed on those results as a basis. But the method which I have described will give satisfactory results, and can be used for large and small gears with equal facility. These gear patterns require no taper, because the metal expands very much more than the surrounding material, and they can easily be lifted out without any trouble whatever, and the material surrounding the pattern being baked hard, of course, has considerable strength, especially when the material has been saturated with some baking material or substance. There will be no difficulty whatever in doing that, and a gear will be obtained which is equally strong in all parts and one which operates with uniformity. Anyone who has seen printing presses run knows how perfect these gears must be in order to run smoothly for long periods of time without the slightest interruption.

I know of gears 48 inches in diameter having been cast that way, which ran perfectly, and the pitch line did not change, because

* From a paper read by Gus. C. Henning at the Hartford meeting of the American Society of Mechanical Engineers.

when the material begins to cool down sufficiently to be a solid mass the clay or sand begins to cool off with it and the two go together. In the first place, the pitch diameter was changed by the expansion of the gear in the mold; but originally that clay was tight to the wheel, and, on the other hand, the molten metal coming in will shrink a little more than the mold will afterwards, so practically they are the same thing. The gears cannot be heard when running, any more than cut gears. If that is true, the gears must certainly be run together so nicely that the variation of pitch diameter is immaterial. They can be seen running on all of the new presses of the Walter Scott Company, in Plainfield, N. J. They are putting them on all presses now, since about two years, and no one knows that he is using cast gears instead of cut gears, because they give the same satisfaction. They are experimenting now on larger gears.

Chemical Analysis and Pig Iron Stocks.

Editor THE FOUNDRY:

In your December number "Krank" calls attention to a statement made in my September article, which I also think is capable of further explanation. When I say that for my daily work one determination often represents three thousand tons of stacked up pig iron, I mean it as an actual fact, but, contrary to "Krank's" supposition, this iron is all bought on specification.

The very idea of using chemistry in the foundry would certainly find as its first application the correct buying of the pig iron. The matter does not end here however. My own experience has been that when I specify either very high or very low silicon iron, the product received is invariably below the point asked for, this in spite of what the car tickets say. When a medium grade is wanted, I invariably receive more silicon than asked for. Perhaps the cause of this difference is in the taking of the samples, perhaps it is elsewhere, so long as one knows exactly what is received, arrangements can be made to use it. High silicon irons are very difficult to make uniform anyhow, and only a large production, heavy storage, and a careful system of piling by analysis will enable the blast furnace to fill orders properly.

The variation which Mr. Phillips notes in the Southern pig irons is only too true, as repeated statements from the other side of the ocean tell us, but coupled to these criticisms there will be found invariably the foot note that these irons were shipped, not by analysis, but by the ordinary uncertain grading by number. Buying iron by a specified analysis, and (if conditions and finances allow) stacking up carload after carload in horizontal layers one over another, and then drawing the daily supply from the ends of these piles, gives a very uniform and representative material. This may explain why one determination can serve for three thousand tons of iron.

R. MOLDENKE.

Jeloluse Core Compound.

For years it has been the study of foundrymen to find a more successful substance for binding sand in core work, one having as little vegetable matter as possible in order to do away with gas and smoke.

Among the many economical articles of this order that have recently appeared is Jeloluse, which, it is said, will do the work of flour, etc., fully and in a superior manner. The manufacturers claim that a good strong core can be made by using 15 parts gangway sand, 15 parts bank or beach sand and one part Jeloluse. For large cores 20 parts old core sand, taken from castings, 15 parts new fire sand, 5 parts of loam molding sand; wet with claywash together with one part Jeloluse is said to give excellent results. For dry sand work Jeloluse is used the same as for large core work.

The manufacturers further state that wonderful results in skin dried work can be had by mixing Jeloluse with silver lead and water and giving the molds a thin coating with this preparation. It is claimed that by burning a small amount of oily waste or placing a hot iron in the mold that a hard and solid mold is procured. In this connection it should be noted that molds or cores made with Jeloluse merely need drying and not baking. For further information on this subject we refer the reader to an advertisement appearing elsewhere in this issue. The company manufacturing this article give assurance that it is practically proving all statements made, by daily use in many leading foundries throughout the United States.

Lycopode and Its Use.

By S. A. WHITEHOUSE.

While gatework and platework in the foundry has been discussed to some extent, there is one feature which has had but little notice, and that is some of the difficulties attached to their use, and also improvements of recent date which tend to save time and expense.

All superintendents of foundries are well aware of the fact that machine molding with patterns fitted on plates, or bench molding with patterns fastened on a gate where a quantity of castings is desired, either fittings or otherwise, light or heavy, a great saving of time and expense is accomplished in preference to gating each pattern separately, and drawing them singly.

Those who have used these improved methods are aware of difficulties arising one way or another, and some of these may be mentioned, such as patterns upon a plate are liable to become damp and adhesive, being constantly imbedded in the necessarily damp sand. Inasmuch that corners, notches, etc., will stick, and hence, when the casting is poured and cleaned, much time is spent chipping and grinding, and the result is, time lost and not a perfect casting. As is often the case, the mold must be dumped out and from five to fifteen minutes spent wearing out brushes by cleaning the patterns. This is the case also with gatework, and especiallly in damp or frosty weather any metal pattern will sweat and draw moisture, causing it to become adhesive.

We noticed at the last year's foundrymen's convention, held in Detroit, a molding machine in operation. The method used to clean the pattern was to apply a brush dampened with kerosene. We observed that the flask, as it was lifted off, looked as if it had had smallpox or something worse, for sand stuck to the pattern in spots, but of course a few trials would bring a perfect mold, and at any rate the pattern must be cleaned every few flasks made from it. We were pleased to notice a compound tried upon this same machine, and the pattern being once dusted with it, the sand would leave readily, and no sticking either, with the pattern clean for another mold. This compound is called Lycopode, and is manufactured by Whitehouse & Company, Kewanee, Ill.; S. Obermayer & Co., agents. It is claimed for this compound that a plate or gate of patterns dusted with it will make from five to eight molds true and perfect. Keeping the pattern always dry and clean, moisture will not affect it, and hence lettered work, hard and deep lifts, gears or any irregular parting may be made more easily, with no rough castings or patched work, as the pattern leaves a perfect mold and lifts cleanly.

There are a few foundries realizing such difficulty with their patterns who have used Lycopodium, although this is very expensive, sometimes costing as much as eighty cents per pound, and yet there is a saving by using it. Lycopode being as efficient as Lycopodium and much cheaper, we believe many foundrymen will be interested in this new article.

H. S. Vrooman, dealer in molding sand and fire brick, of 220 W. 20th street, Chicago, has gotten up one of the most useful articles that could be given to a foundry. It is a book suitably spaced and nicely bound for keeping track of cupola mixtures and the results obtained therefrom. This will furnish a permanent reference book and is something which most foundries, we are sorry to say, are badly in need of. If you like to know what you are doing get one of these books. We believe they are issued as a compliment to managers of foundries.

"American and Other Machinery Abroad" is the title of a 90-page book, bound in flexible covers and issued by the press of the American Machinist. The contents are the results of observations made by the author, F. J. Miller, editor of the American Machinist, while touring abroad among foreign workshops. Mr. Miller has always given evidence of possessing the happy faculty of making others see things as seen by himself and his present work is no exception to that rule. Those who like to know what others are doing, and incidentally what we, as machinery producers, are doing for others, will find enough material in this little book to last them for some time to come.

Rogers, Brown & Co. are mailing a neat calendar to the trade.

NOTICE!

Advertisements in this column, 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than the 20th to insure publication.

Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, we will give one free insertion under this heading to those in want of positions, the advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

FOR SALE—First class cupola and six-ton foundry jib crane. Pawling & Harnischfeger, Milwaukee, Wis.

WANTED—Position by a practical molder; 20 years' experience on heavy and light machinery and jobbing work. Temperate and well recommended. Address G. J., Box 106, care THE FOUNDRY.

WANTED—A foreman for foundry employing 40 to 50 men; melting 20 to 25 tons; work of a heavy nature such as columns and general castings; state experience. Address, Box No. 105, THE FOUNDRY.

AN A1 FOUNDRY FOREMAN desires to make a change. Competent to conduct any part of the foundry business. Best of references. Only those wanting a first-class man should apply to Box 27, care THE FOUNDRY.

FOR SALE—A small foundry with established and profitable business; one-half interest or the whole at the rate of $5,000 for the whole. An excellent chance for an office man. CRAWFORD & CONOVER, Seattle, Washington.

BARGAINS IN BLOWERS—We have on hand three No. 6 second-hand blowers, taken in trade for larger machines; thoroughly overhauled and guaranteed as good as when new. P. H. & F. M. ROOTS CO., Connersville, Ind.

WANTED—A situation as brass foundry foreman. Have had twelve years' experience on both light and heavy castings and can come well recommended as to my ability in mixing metals and handling men. Address Box 97, care The Foundry.

WANTED—A position as brass foundry foreman, an active, reliable, temperate man, a practical and chemical mixer of all grades of metals, old and modern mixtures, and one who can produce sound, clear castings at a low cost for production. Address T. J. M., Box 104, care THE FOUNDRY.

WANTED—A molder with a fair education and about $2,000 to invest who has had experience in making job work weighing from 1,000 to 5,000 lbs.; is qualified to have sole management of a foundry employing from ten to twenty molders and the necessary help; understands melting and mixing iron, and is a judge of what price should be received for various castings so as to receive a profit; good references required. For further information inquire of GEO. WIARD, Batavia, N. Y.

An Opportunity for Someone.

The attention of those looking for a chance to enter an established trade is called to advertisement which appears on page 22 of this month's issue. We shall be pleased to answer any inquiries made by reliable parties.

By Way of Advertising.

The Shields Foundry Company, of Mansfield, Mass., have favored us with a calendar "right up-to-date."

The Joseph Dixon Crucible Co. evidently believe in the "Power of the Press," as they have furnished us with some American Graphite Pencils to aid in making our thoughts run smoothly during the coming year. They are all right, that is, Dixon's Pencils.

F. B. Stevens not only believes in advertising, but in making his advertisements talk business. We are not much out of the way in saying that his advertisements are always read, and the reader as well as ourselves, only wish he would make his ads. larger. We are reminded of this by several examples of the art of advertising lately issued by Mr. Stevens, among which is an elegant calendar.

The Mansfield Tempered Copper Co., of Mansfield, O., have forwarded us one of their copper letter openers, the polished surface of which remind us that this company are producing copper castings without any of the blemishes usually found in that class of work. While they do not claim to make cutlery of copper, they certainly make a good article for the purpose for which they intend it to be sold, that is, as commutator segments.